

APR 13 1947

# Electrical Construction and Maintenance

*With which is consolidated* ELECTRICAL CONTRACTING

APRIL · 1947

## *Don't Miss*

Detroit Motor Shops . . . . .	page 49
Weight Factors in Estimating . . . . .	page 53
Modernization Begins with Wiring . . . . .	page 54
P A System Installation . . . . .	page 57
Industrial Lighting Techniques . . . . .	page 60

## *In This Issue*

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# Electrical Construction and Maintenance

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*The Electrician and Electrical Record*...Established 1901

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and others, covering engineering installation, repairing, maintenance and management, in the field of electrical construction and maintenance.

## April • 1947

April—at a glance .....	45
Folks Want Pushbuttons .....	47
Detroit Shops in Action.....	49
By AUGUST ECKEL—Ideas developed by Detroit motor shops to speed electrical equipment repair service.	
Weight Factors in Estimating.....	52
By RAY ASHLEY—This article shows how weight factors are used in determining labor units.	
Modernization Begins with Wiring.....	54
By HUGH P. SCOTT—Extensive distribution system, photo-electric controls and modern protective devices serve multi-motored equipment in progressive linoleum manufacturing plant.	
Public Address System Installation.....	57
By W. M. JUREK—Practical data on the installation of modern sound systems for industrial, commercial, and institutional applications.	
Industrial Lighting Techniques.....	60
By BERLON C. COOPER—A discussion of lighting equipment and lighting layouts for industrial plant illumination when fluorescent lamps are used.	
Spacing Highway Lighting Units.....	63
Mounting height of light source, luminaire characteristics, lumen output of lamps and design of traffic lanes affect computations for determining the spacing of highway lighting units.	
Industrial Electrification .....	81
Overload and Short-Circuit Protection of Industrial Control Equipment	

## Departments

Practical Methods .....	64	Motor Shops .....	107
Equipment News .....	73	Modern Lighting .....	115
Reader's Quiz .....	92	In the News.....	125
Questions on the Code.....	99	Manufacturers News .....	144
Advertisers' Index .....		166	

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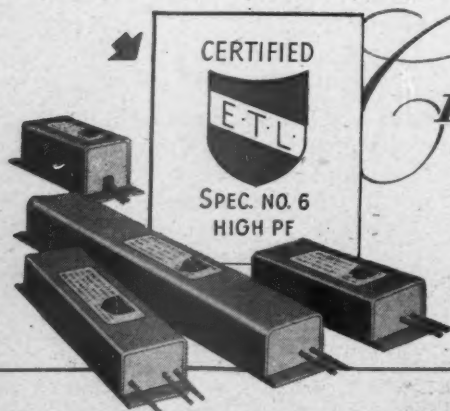
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# APRIL . . . . at a Glance

## Apartment Conversions

Inspectors are discovering that many recent conversions of single family homes into multiple dwelling units show too little regard for increased electrical loads. The very urgency of such conversions under the housing shortage has aggravated the problem. Very often the original wiring system remains intact with all of the new outlets connected to already overloaded circuits. With the present urgent need for housing, city officials have been reluctant to press the rules too vigorously in such conversion jobs. However, the resulting fire hazards are too serious to ignore. All such conversion jobs should be re-inspected now and the hazards corrected before we have an epidemic of electrical fires.

## Wiring Modernization

Wiring today is often the spearhead of industrial modernization and is playing an increasingly important part in the adaptation of industrial plants to new methods and processes. And these wiring jobs are often extensive and complex. Hugh Scott's story about the Congoleum Nairn plant is an excellent example of some of the problems encountered in industrial wiring modernization. You will find the story "Modernization Begins with Wiring" on page 54.

## Sounding Off

Everyone knows what public address sound systems look like and pretty much how they work, but there is a lot of know-how and detail to the selection of equipment and its

installation that makes the difference between a good job and a mediocre installation. So your editors asked William Jurek of the Langevin Company, a well known manufacturer of industrial and commercial sound public address systems, to bring together the essential facts and figures on selection and installation. You will find the story "Public Address System Installation" on page 57 in this issue. This is a "must" item for everyone who is concerned with the installation and care of this type of equipment.

## More Industrial Lighting

Following last month's introduction to Industrial Lighting Techniques, Berlon Cooper brings us the second article in his series, which discusses lighting equipment and lighting layouts for industrial plant illumination when fluorescent lamps are used. You will find this up-to-the-minute series on industrial lighting practice useful reference data for today's industrial lighting jobs. You will find "Industrial Lighting Techniques" on page 60.

## Overload Protection

A thorough review of the problems and methods of protecting against overloads and short circuits in industrial control equipment, by G. W. Huemann of General Electric, will be found in our Industrial Electrification section this month. We feel that the subject is particularly timely in view of the phenomenal amount of industrial modernization now under way. Everyone concerned with installation and adaptation of industrial

control equipment will find Mr. Huemann's article both informative and immediately useful.

## Estimating by Weight

While most labor units used in electrical estimating are developed around the number of items or dimensional characteristics, labor costs are often determined by the relative ease or difficulty of handling. In such instances, weight, as a variable, is often closely related to labor cost. Ray Ashley, whose published work on estimating has attained the stature of a standard authority on such matters, explores this phase of estimating procedure in his article, "Weight Factors in Estimating" in this issue. The correlation of weights to labor cost are shown in curves applying to conduit and to pull boxes. You will find this interesting study on page 52.

## Detroit Shops

Detroit was the focal point of the electrical repair shop industry last month at the annual National Industrial Service Association convention. A good many of the delegates took time to visit Detroit motor shops and to study facilities and methods which are used there to meet the needs of the great mass production industries of the area. We thought that a good many of the motor shop folks who couldn't go to Detroit might still like to look around, so Gus Eckel went the rounds with his camera and notebook and brought back his picture story "Detroit Shops in Action", which you will find on page 49.

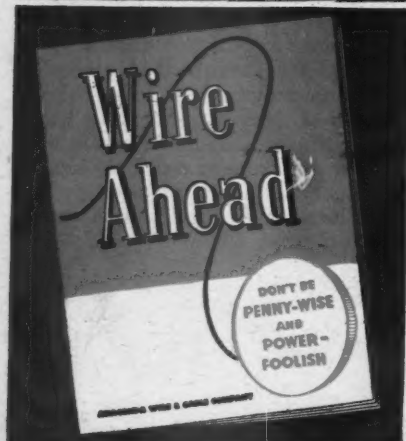
# Arrest this Thief!

Because adequate wiring is basic ... and affects everyone in our industry ... Anaconda continues to promote this idea in a wide list of national magazines.

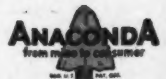
INADEQUATE WIRING, the industrial jinx, can rob any plant large or small ... of as much as 25 to 50 per cent of rated efficiency. And what's most discouraging, the greater the production load, the deeper he digs into your resources.

Obsolete, overextended, overtaxed wiring may be difficult to detect, but it's too expensive to ignore. You may not be able to see this demon, but your plant power engineer, your consulting engineer, electrical contractor, or utility power salesman can. A little policing now may save expensive alterations later.\*

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\*WIRE AHEAD, a new booklet discussing preventive maintenance ... the symptoms of inadequate wiring ... and presenting plans for anticipating electrical demand, is now in preparation. We shall be glad to send it on request as soon as it is available. Address Advertising Department, 25 Broadway, New York 4, N. Y.



**ANACONDA WIRE AND CABLE COMPANY**



APRIL, 1947

# FOLKS WANT PUSHBUTTONS

THE DRAMATIC, almost fantastic, interaction of electrical circuits in industrial processes is a matter of great wonderment to the lay public. But to electrical men they are only more or less elaborate hookups of a few basic types of relays and devices which respond to appropriate physical phenomena. Once the control stimulus is converted to an electrical impulse there is virtually no limit to the complexity of operation that may be initiated or the force which may be applied thereby.

IT IS UNFORTUNATE that we, through our understanding of control operations, lose so much of the layman's viewpoint. We know, for instance, that a push button control costs more than a manually operated switch; that an automatic feature, such as a thermostat, costs more yet; that interlocking two or three operations adds additional expense and so on. So with controls we are likely to operate under our own "law of parsimony." We tend to apply the least elaborate control that will provide the desired operating results and an appropriate degree of convenience. The less well informed man-in-the-street expects a "push button" world. He thinks that the barriers which deny it to him are technological when, in fact, they are economic and traditional. He can have any part of his "push button" world right now if he wants to pay for it. He will also need the stamina to break down the stubborn reluctance of the electrical industry to provide more than the minimum essentials.

THE APPLICATION OF CONTROLS to power and light needs imagination and understanding beyond the electrical requirements of the loads involved. Controls must be seen not only as a part of the electrical circuit, but as a part of the process or function of the related load. And it is precisely here that we and the man-in-the-street usually part company. To him a switch turns the lights on and off. To us it makes and breaks an electrical circuit. And in our preoccupation with electrical details we sometimes forget the real purpose of the controls we install. We have all seen perfectly good magnetic motor starters, for instance, with push buttons in the cover installed in inconvenient and sometimes practically inaccessible places.

IN THE NEXT FEW YEARS we shall see a great expansion of electrical utilization, new applications of power and light and communication. It can be speeded or retarded by our willingness to meet the public demand for clever and convenient control. Is the conventional wall switch the last word in lighting control? Is a motor starter the end of our ingenuity in the average motor application? Must the amazingly complex and useful control devices of the automatic machine tool, the chemical process industries or the world of communication be isolated there? I don't think so. In fact, we can give the public many conveniences and a world of new comfort if we'll put our minds to it.

*Wm. J. Stuart*

**Electrical Construction and Maintenance**

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hot spot  
your customer  
wants to  
ventilate...**



**what's  
the best  
equipment?**

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*Conveyor speeds assembly at Spaulding Electric Company. Conveyor starts at back of room, goes through cleaning and sand blast booths, coil making department, assembly section, then over to dip tank and bake oven. Work benches, at conveyor height, are staggered at five-foot intervals along the line.*



# Detroit SHOPS in ACTION

Ideas developed by Detroit motor shops to speed electrical equipment repair service. Many of these illustrated were viewed by delegates to recent NISA Convention.

By August Eckel

**E**LECTRIC equipment service and repair is a man-sized business in Detroit. Technical skill, operating ingenuity and planning enable individual motor shops to turn out from 35,000 to 270,000 horsepower of equipment repairs annually. Collectively, the dollar volume approaches the three million mark.

Much of their success in serving Detroit's diversified industrial requirements can be at-

tributed to the constant development of practical methods and techniques that improve shop operation and customer service. What some of the leading shops have done in this respect is presented in the behind-the-scenes photographs shown. Many of these ideas were noted by motor shop operators from all over the country during last month's National Industrial Service Association convention.

*Large equipment repairs are made in the field as well as in the shop. Stator coils made in the shop were installed on the job. Here, Spaulding Electric Company mechanics put the finishing touches on a rewound compressor motor.*



**For that  
hot spot  
your customer  
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ventilate...**



**What's  
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*Large equipment repairs are made in the field as well as in the shop. Stator coils made in the shop were installed on the job. Here, Spaulding Electric Company mechanics put the finishing touches on a rewound compressor motor.*





*Rewinding a magnetic pulley at Miller-Seldon Electric Co.\*Special winding machine has lathe chuck at driving end, bearing support for shaft at other end. Bearings to fit individual shafts can be locked in place at the stationary support. Rewound pulley is to be used on a magnetic separator in an automotive foundry.*



*Mass production techniques are employed by Jay Electric Company for assembly of fractional horsepower d-c motors. At an adjacent bench, the stators are wound.*



*Coils for all but largest motors are wound and taped to specification in this department at Jay Electric Company. Coils are grouped and tagged for specific job orders, then delivered to the assembly bench.*

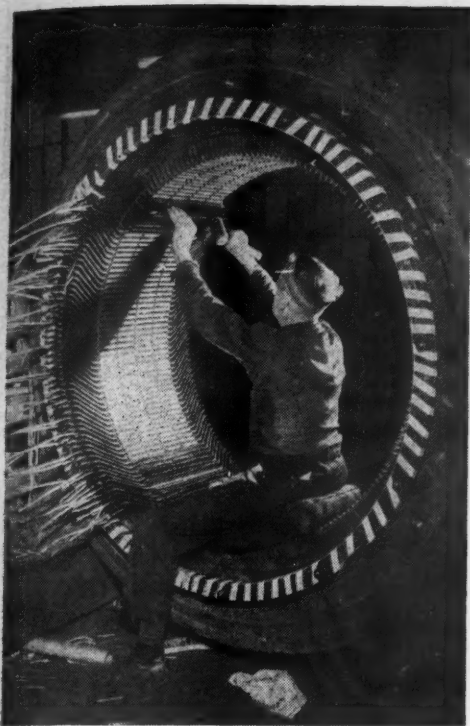
*Diversification is one of the features of Jay Electric Company. Here, mechanics are engaged in sub-assembly of d-c armatures for industrial electric trucks.*



*Semi-enclosed dip tank booth designed by Howard Electric Company incorporates safety features approved by Fire Marshall. Strong exhaust fan at top of "booth" draws varnish fumes up the sides behind U-shaped metal baffle. Limit switch arrangement automatically starts fan when cover is lifted a few inches. Metal fuse links connecting counter-weight cable to tank cover melt in case of fire; drop cover which snuffs out flames.*







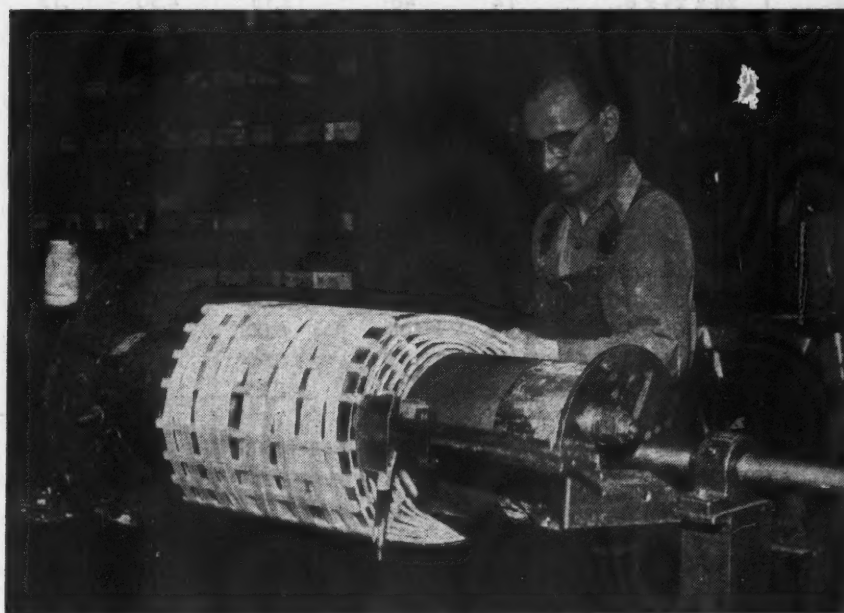
Large or small, difficult or easy—shops handle all types of jobs. Here, a 375 hp., 6600-volt, 430 rpm. motor is being rewound at the Miller-Seldon Electric Company for use at different voltage and speed.



Factory techniques are employed in the carbon brush department at Howard Electric Company. When brushes are needed in a hurry, Howard cuts them from stock carbon. Here, a mechanic is using a device designed to insert lead wires. Copper wire is fed through hollow plunger, down through hollow "needle" into brush hole. A self-setting compound poured around wire in brush hole seals the lead. Tamping action pressure of "needle" causes compound to harden.

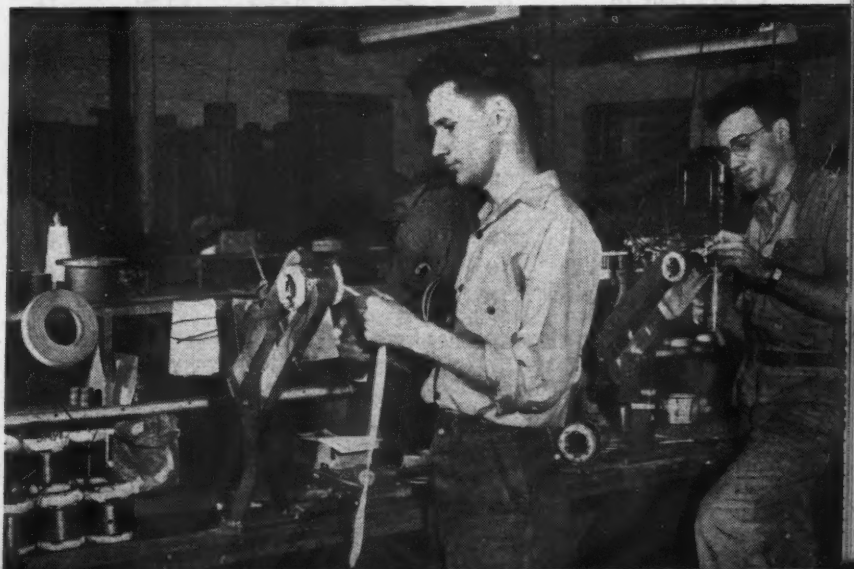


Cathode-ray oscilloscopes are used extensively by Spaulding Electric Company. With the 'scope, they can determine interpole strengths and main field distortions in generators, and uncover other factors that otherwise can be detected only by extensive tests and calculations. Second instrument in photo (at right) is an electronic switch used to put two wave forms on screen simultaneously.



Rewinding a 240-kva., 3-phase 440/120 to 8-volt air cooled transformer with special high temperature insulation (asbestos, transite and glass) at Miller-Seldon Electric Company. This is indicative of the service problems a shop encounters.

High frequency portable electric tool repair is one of the specialties of Jay Electric Company. At this stator winding bench, adjustable wooden jaws hold units securely while coils are installed and taped.



**TABLE I**  
**CABINETS AND BOXES**  
**LABOR IN HOURS FOR MOVING IN & SETTING**  
 Add for Pipe Entrances and Right Angle Cable Pulls

Size (inches)	Gauge Steel	Approx. Wt. (lbs.)	Hours Wall	Hours Cell.	Unit For Ea. 1' Change In Depth	
					Wall	Cell.
12 x 12 x 4.....	14	11.5	1.30	1.85	...	...
12 x 18 x 4.....	14	16	1.45	2.00	...	...
12 x 18 x 8.....	14	22	1.65	2.30	...	...
12 x 24 x 4.....	14	21	1.65	2.30	0.10	0.12
12 x 24 x 8.....	14	28	2.10	3.10	.10	.12
18 x 24 x 4.....	14	27	2.10	3.00	.11	.13
18 x 24 x 8.....	14	35	2.65	3.70	.11	.13
18 x 30 x 4.....	14	35	2.65	3.70	.13	.16
18 x 30 x 8.....	14	44	3.10	4.30	.13	.16
18 x 30 x 12.....	14	53	3.70	5.20	.13	.16
24 x 24 x 4.....	14	37	2.65	3.70	.13	.16
24 x 24 x 8.....	14	46	3.15	4.50	.13	.16
24 x 24 x 12.....	14	55	3.85	5.40	.13	.13
24 x 30 x 4.....	14	45	3.10	4.30	.15	.17
24 x 30 x 8.....	14	54	3.75	5.20	.15	.17
24 x 30 x 12.....	14	64	4.30	6.00	.15	.17
24 x 36 x 8.....	12	88	5.20	7.40	.20	.25
24 x 36 x 12.....	12	104	6.00	8.70	.20	.25
24 x 42 x 8.....	12	100	5.70	8.20	.22	.28
24 x 42 x 12.....	12	117	6.70	9.50	.22	.28
30 x 30 x 8.....	12	90	5.30	7.50	.22	.28
30 x 30 x 12.....	12	106	6.00	8.80	.22	.28
30 x 36 x 8.....	12	105	6.00	8.80	.24	.30
30 x 36 x 12.....	12	122	6.90	10.00	.24	.30
36 x 36 x 8.....	12	122	6.90	10.00	.25	.32
36 x 36 x 12.....	12	140	7.50	11.25	.25	.32
36 x 36 x 16.....	12	158	8.40	12.50	.25	.32
36 x 42 x 8.....	10	178	9.00	13.50	.28	.35
36 x 42 x 12.....	10	204	10.00	15.00	.28	.35
36 x 42 x 16.....	10	230	11.00	17.00	.28	.35
36 x 48 x 8.....	10	205	10.00	15.00	.30	.38
36 x 48 x 16.....	10	227	11.00	16.75	.30	.38
42 x 42 x 8.....	10	194	9.60	14.50	.30	.38
42 x 42 x 12.....	10	221	11.00	16.50	.30	.38
42 x 42 x 16.....	10	248	11.50	17.75	.30	.38
42 x 48 x 8.....	10	227	11.00	16.80	.32	.40
42 x 48 x 12.....	10	256	11.50	18.50	.32	.40
42 x 48 x 16.....	10	286	12.00	20.00	.32	.40
42 x 60 x 12.....	10	310	13.00	22.00	.35	.44
42 x 60 x 16.....	10	348	14.00	23.50	.35	.44
42 x 60 x 20.....	10	382	15.50	26.00	.35	.44
48 x 48 x 12.....	10	285	12.00	20.00	.35	.44
48 x 48 x 16.....	10	317	13.00	22.00	.35	.44
48 x 48 x 20.....	10	348	14.00	23.50	.35	.44
48 x 60 x 16.....	10	379	15.50	26.00	.38	.48
48 x 60 x 20.....	10	415	16.00	28.00	.38	.48
48 x 72 x 16.....	10	440	16.50	29.00	.40	.50
48 x 72 x 20.....	10	480	18.00	31.00	.40	.50
60 x 60 x 20.....	10	475	18.00	31.00	.40	.50
60 x 60 x 24.....	10	515	19.00	33.00	.40	.50

No allowance has been made for Special Supports.  
 Weights per square foot of steel:  
 No. 14—3.2 lbs., No. 12—4.5 lbs., No. 10—5.75 lbs.

# Weight

By Ray Ashley

**W**EIGHT is always an important factor in figuring labor costs. Estimators should become familiar with the weights of standard materials and always obtain weight data on special equipment. The weight often determines the number of men required, the speed of moving, the type of tools and handling equipment needed, and the design of hangers and platforms is also dependent on weight information. In practically every branch of electrical work weights are important for creating fundamental estimating units.

The extent to which this factor enters labor costs depends largely on what portion of the total time required is necessary for handling. In the case of cable pulling it affects principally preparation labor and removing installation equipment. Setting up reels, pulling equipment, cable brakes and removing equipment is all a matter of handling so much weight. Aside from the cost of conduit entrances and the additional cost of pulling cable, pull box installation is largely dependent upon the bulk handled. The time required for installing conduit of various sizes presents a unique case of installation costs paralleling weight. This is shown graphically in the accompanying curve. A study of the data will show that over 30% of the time is essentially handling labor. The study also indicates that other operations vary quite consistently with weight. The same rule, however, does not work out with wire. The cost per pound, starting with Number 12 or 14 drops off very rapidly until we reach the 500,000 circular mil class. It is not until one reaches the 1,000,000 circular mil class that the weight and labor costs curves begin to near a parallel cost. In the case of wire and cable pulling, there are too many repair operations which do not vary in proportion to the weight involved. For instance, it takes almost as long



# Factors In Estimating

Labor costs are often a direct function of the weight of materials and apparatus.

This article shows how weight factors are used in determining labor units.

to prepare for pulling Number 3 cable as it does for 500,000 circular mil cable.

Pull boxes and cabinets present no end of variations in sizes and weights. This possibility of variation creates a need for tables and curves which can be used as estimating guides.

All other things being equal, the installation (not including conduit terminals) of boxes weighing twenty pounds or more, varies quite consistently with the weights. Knowing this, the estimator can use the time studies from a few jobs as a basis for fabricating complete tables of box labor units. The accompanying example of a work sheet, "Labor Studies for Pull Box and Cabinet Installations," shows how this is accomplished.

Like all labor units, those for pull boxes and cabinets must be raised or lowered to comply with the job at hand. Take, for example, a 200 lb. box and consider two cases:

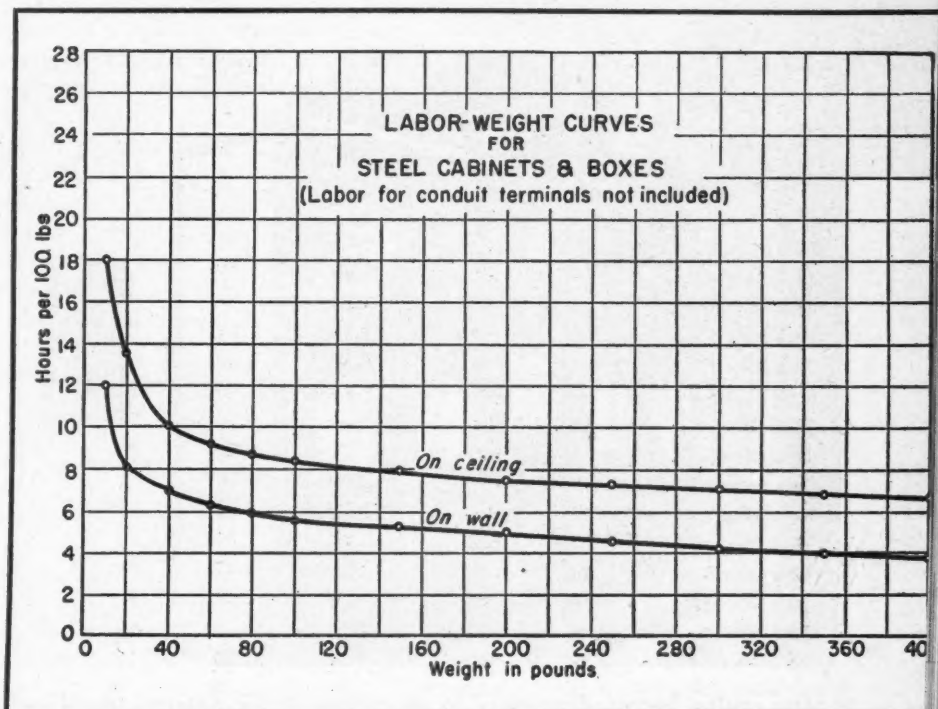
Case I—

- (1) Delivery well timed (at 8:00 a.m.) before men are out on the job.
- (2) Moved directly to the point of installation (not necessary to store).
- (3) First floor installation.
- (4) Proper equipment for hoisting in place readily available.

Case II—

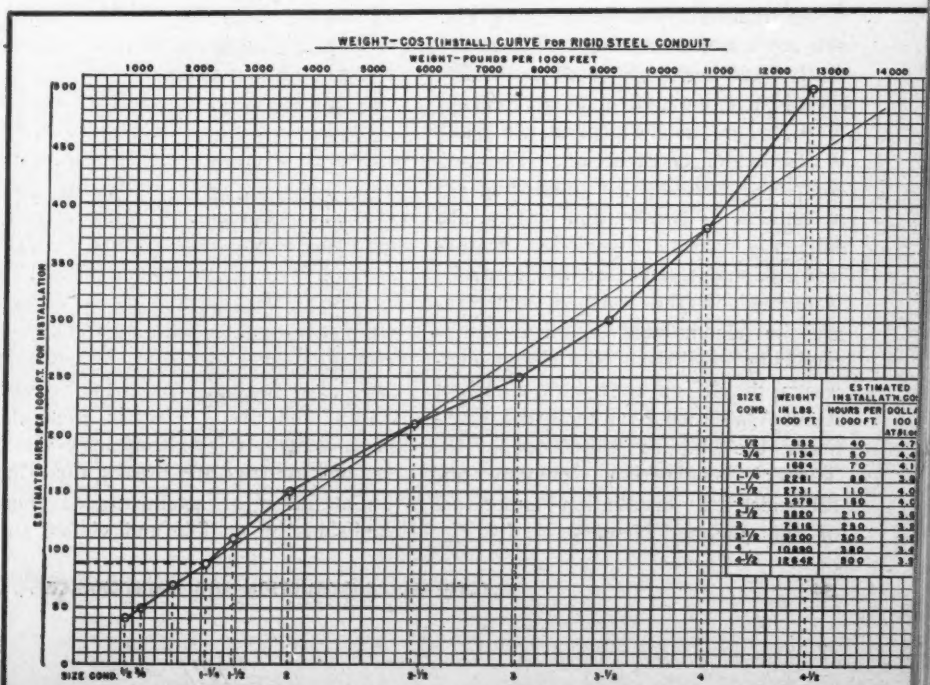
- (1) Untimely delivery (men called in off of job to unload).
- (2) Put in storage and later delivered to point of installation.
- (3) Installed on upper floor, time lost waiting for elevator.
- (4) Proper tools and hoisting equipment not available.

There would in all probability be 100% more labor involved in the second case, than would be in the first. In addition to job conditions there is always the labor market which has to be reckoned with.



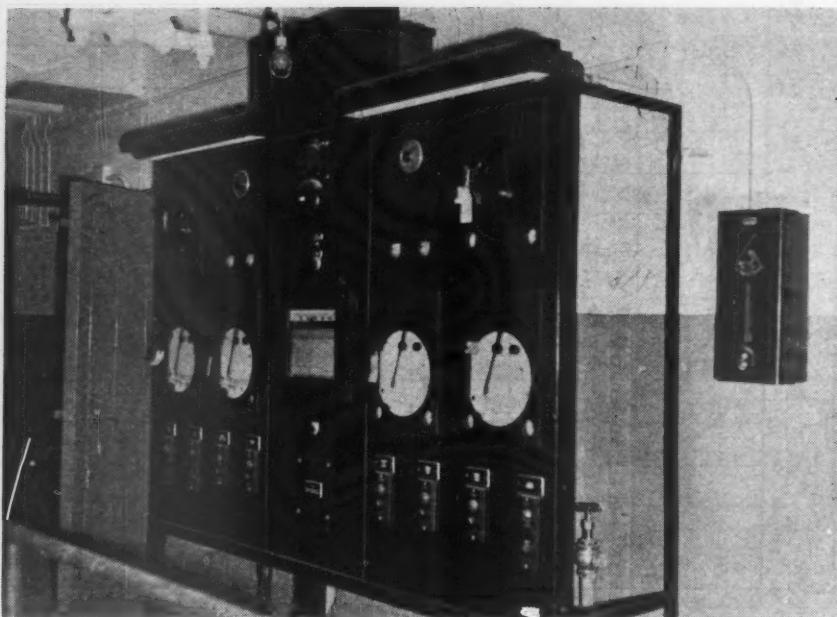
For estimating purposes it can be assumed that the time required for installing pull boxes varies in proportion to the weights. Note—the above curves do not include labor for conduit terminals.

Curve of conduit installation cost related to weight. Basic labor cost projections can be developed from job experience data when weight or handling time is a major factor.



# MODERNIZATION

## Begins With WIRING



*Stove control boards, illuminated by fluorescent border fixtures, record and regulate oven temperatures. Pushbutton controls are for heat supply and exhaust, electric eye and recording equipment.*

**E**LECTRICAL reliability is a dominant factor in Congoleum-Nairn's present nine million dollar expansion and modernization program. As an important part of this program, new stove and examining buildings recently have been completed at the 50-acre Nairn linoleum plant at Kearny, N. J., where a new asphalt tile plant is also under construction. The two completed buildings, representing an investment of two million dollars, are efficiently operated by modern motorized equipment and electronic controls. Combined in the finished structures are the accumulated technical manufacturing abilities of Congoleum-Nairn, the design know-how of Albert Kahn Associated Architects and Engineers, the building knowledge of the Turner Construction Company and the electrical installation experience of Paul Jaehnig, Newark, N. J.

The new stove building (covering an area of 28,400 sq. ft.) includes nine huge curing ovens (60 ft. high, 177 ft. long) in which continuous lengths of linoleum (each six miles in length) are looped in series of 90-foot festoons during the aging cycle.

In this building, the electric service entrance, main distribution panel, transformers, elevator machinery, stove control boards, linoleum feeding and removal equipment, lighting panels, sump and circulating pumps, heating fans and door operators are located on six floor levels occupying a 32-foot width across the building's 132-foot frontage. Exhaust and jet cooling fans are located over the ovens. Within the ovens, electric eyes and photo-electric relays constantly check festoons for sags and breaks, directing the attention of attendants to these conditions by audible and visible sig-

nals. Thermocouples positioned strategically at all critical points throughout the stove areas record temperatures and motivate electrical controls operating wall-mounted steam coils. Attention required of plant personnel is mainly supervisory, since regulation and operation is completely automatic during the aging period.

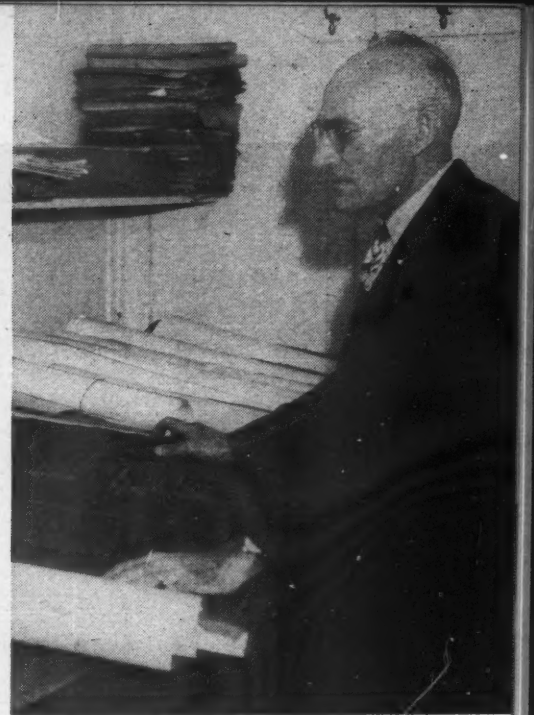
Placing the new stove building in operation will greatly increase output, since production is governed by adequacy of curing facilities. After linoleum is mixed, placed on felt or burlap backing by calender or automatic in-laying machines and initially prepared for curing, festoons of this raw material are suspended in stoves or ovens where constant temperatures of approximately 175 degrees F. and regulated ventilation are maintained for periods of from two to six weeks, depending on thickness and desired firmness, resilience and toughness of finished product. In the nine-month period required to convert the raw materials (linseed oil, kauri gum, resin, cork and wood flour) to finished linoleum, this aging cycle is the slowest process. Although seasoning cannot be hurried, this addition to the already large stove space of the Kearny plant will make possible greater utilization of the roll-a-minute capacity of each of the two automatic straight-line in-laying machines and the calender machines which produce battleship, plains and jaspes.

Primary current, transformed from the utility voltage of 13,200 to the distribution level of 550 volts, 3 phase, 3 wire, 60 cycle, ungrounded, is carried through the plant area in WP cables, pole mounted. These power lines are carried along the west exterior wall of the stove building at the third floor level, supported by two 6-inch I-beams which extend 4 feet from the building face and are bonded to the concrete building columns by angle



**The extensive distribution system, photo-electric controls and modern protective devices serve multi-motored equipment in progressive linoleum manufacturing plant.**

**By Hugh P. Scott**



**Leon C. Fund, supervising engineer for electrical contractor Paul Jaehnig, studies riser diagrams for Congoleum Nairn's new stove and examining buildings recently completed at 50-acre linoleum plant, Kearny, N. J.**

irons and hooked anchor rods. Six 900 MCM cables are carried on the upper beam, six 750 MCM cables on the lower arm and two 500 MCM d-c cables suspended below the bottom beam. Service to the stove building is through three 500 MCM WP cables, tapped to three of the a-c outside mounted lines supported by the lower I-beams. Miscellaneous service (telephone, ADT system and stove warning signals) are carried into the building through  $\frac{3}{4}$ -inch conduit at a separate location. Independent wiring and a separate system of conduit outlets serve emergency, exit and night lighting units.

The main service disconnecting device is a 600 volt, 400 amp., 3 pole air circuit breaker. Secondary power operates at the 550 volt level while secondary lighting circuits are 115/230 volt, single phase, 3 wire, 60 cycle, supplied by three air cooled dry-type

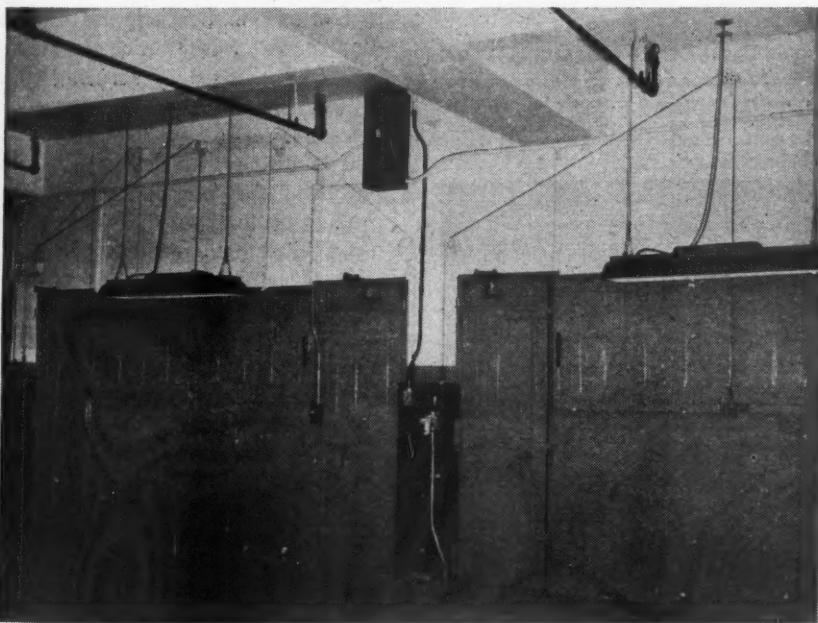
25 kva. transformers. A 550 volt feeder to a 7.5 kva. transformer for emergency service is connected to the incoming service ahead of the main breaker. All major equipment enclosures are grounded, as well as transformer cases, conduit systems, neutral of lighting transformers, transformer supporting structure, power panels and cabinets, and wire screens around transformers and switchboards.

Power feeders run from the main distribution panel to pump room, elevator machine room, curing oven ventilating supply fans, pulling and filling machines, sump pump, door operators and low-voltage control transformers mounted on stove-heating control boards. Feeders are carried in rigid conduit of  $\frac{3}{4}$ -inch diameter or larger. Underground conduit is encased in three inches of concrete. All wires installed underground, in slabs over unexcavated ground and deep locations

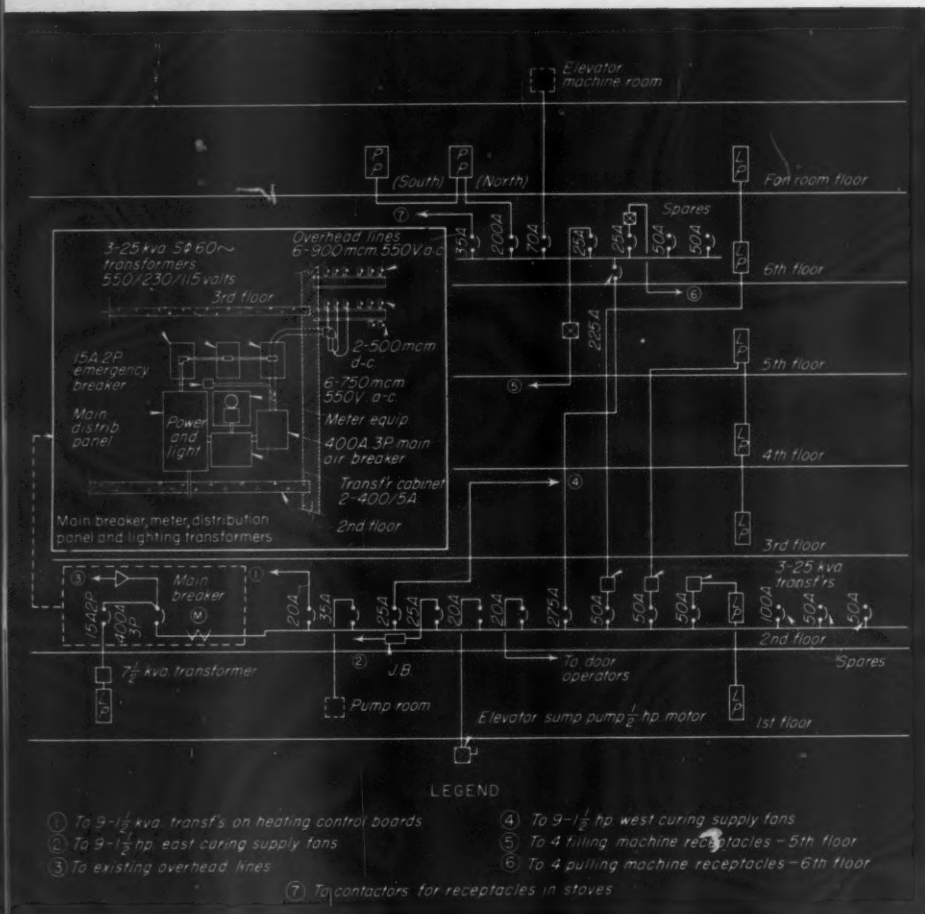
are either lead covered or moisture-proofed rubber insulation. The smallest branch circuits are No. 12 gage wires. Conductors installed in stove areas have AVB, RH or R type insulation, depending on location and temperature conditions.

Automatic regulation of stove temperatures during the curing cycle is governed by thermocouples located at critical points within the ovens. Heat is supplied through series of finned steam coils mounted on all walls and carrying steam under 15 lb. per sq. in. pressure. On stove control panels, located on the second floor level in front of the nine stoves and illuminated by top-strip fluorescent fixtures, temperature of controlled air is indicated and an automatic temperature recorder constantly plots stove temperatures against elapsed time. Also mounted on control panels are pushbutton controls for jet cooling supply and stove cooling exhaust, curing supply and exhaust, recording equipment and electric eye operation.

The photo-electric relays and their motivating light sources are set into recesses in the front and rear oven walls a foot above the finished floor lines. Should festoons sag or break during curing, the light beams would be interrupted, relays would activate audible and visible signals and plant personnel would be notified of the trouble. Audible alarms are horns

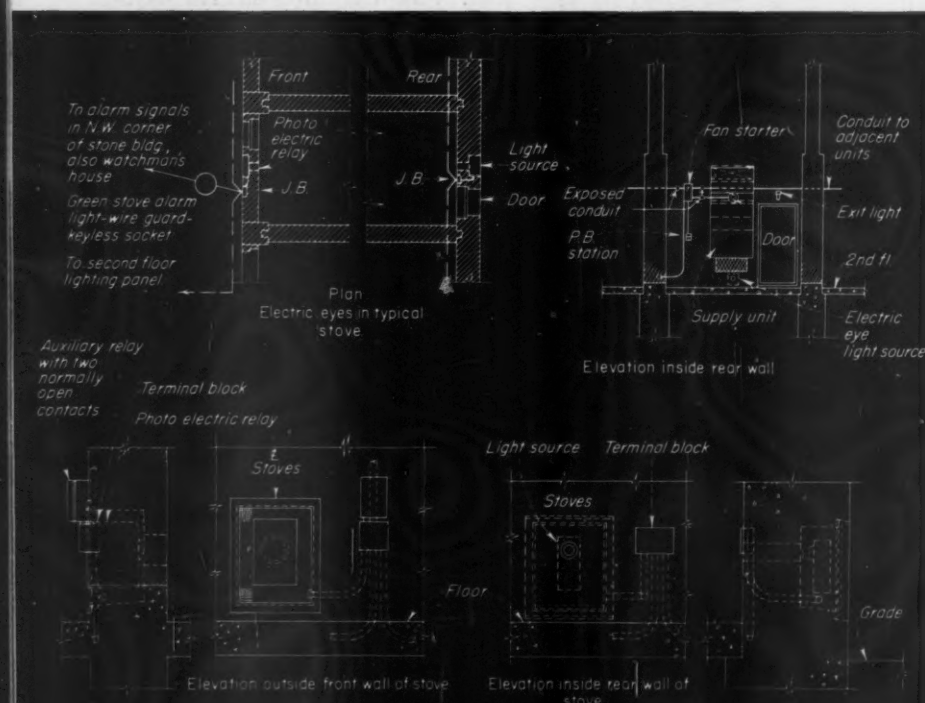


**Inspection lights (RLM fluorescent fixtures mounting three 40-watt white lamps) illuminate area in front of 6th floor linoleum loading ports which are covered by counterweighted fire-retarding sliding doors. Remote control key-operated pushbuttons operate magnetic starters for receptacle circuits serving 10 hp. filling machines.**



**Riser diagram for stove building indicates main service breaker, metering equipment, distribution panel, lighting current transformers, disconnecting circuit breakers and layout of sub feeders. Service is through 500 MCM cables tapped to a-c power lines carried along exterior of building by I-beam supports. Breakers, transformers, metering equipment and dead-front panels are enclosed by grounded wire-screen cage.**

**Photo-electric relays and light sources, recessed into front and rear oven walls a foot above finished floor lines, activate audible and visible alarms if linoleum festoons sag or break during curing process. Audible alarms are weatherproofed horns with 500-foot audible radii, mounted outside of watchman's house and on outer side of stove building. Horns are driven by single phase, 110-volt motors.**



(110 volt, single phase, motor driven, weatherproof, 500 feet audible radius) mounted on the outer surfaces of the stove building and the watchman's gate house. Personnel entering the stove building in answer to the horns are directed to the specific oven by a lighted 25-watt green lamp mounted on the top of each control panel. An alarm system is also connected with the sprinkler flow switch.

All switches, fixtures and other electrical work inside the stoves conforms with N.E.C. regulations for vapor-proof areas. Linoleum inspection lights over the charging and inspection ports are fluorescent units, containing three 40-watt 3500-degree white lamps.

The new examining building, occupying more than an acre of ground, includes a high crane bay, storage area, final finishing and inspection departments. Power and lighting characteristics are similar to the stove building. Electrical equipment includes motors for elevators, cranes, door operators, fans, dampers and unit heaters. Lighting combines both incandescent and fluorescent lamps with spacings, mounting heights and installation details varying in accordance with purpose and visual demands of the several areas.

In this building, the seasoned linoleum receives a finishing treatment of nitro-cellulose and wax to seal the smooth, dense surfaces against dirt and moisture during handling, installation and use. The final, critical, foot-by-foot examination is in the inspection department where long examining tables, illuminated by suspended rows of two-lamp 40-watt fluorescent fixtures and series of 300-watt incandescent lamps in 14-inch domes, support the unrolled linoleum. The approved product is finally rolled, labeled and packaged for shipment.

In the crane bay, storage area and waxing department, 500-watt incandescent lamps in dome fixtures constitute the primary source of illumination. All fixtures and wiring in the finishing and waxing department comply with N.E.C. requirements for explosion-proof installations.

These two completed buildings of reinforced concrete, brick and structural steel greatly augment Congoleum-Nairn's output capacity, improve plant efficiency and make possible the addition of new products. The electrical distribution system, motor controls, protective equipment and lighting installations are major factors in this picture of progress.



# Public Address System Installation

By William M. Jurek  
The Langevin Co., Inc.

Practical data on the installation of modern sound systems for industrial, commercial, and institutional applications.

**T**HE first consideration in selecting a sound system is the type of service the system must provide. For paging, or voice reproduction, the system is relatively simple, having only to reproduce satisfactorily a band width from 300 to 2000 cycles. For music, a broader band width is required. Other factors to be considered are the power required for the area to be covered, and the type of location, such as indoor and outdoor.

The amount of audio power may be easily calculated for an industrial system if the number of square feet to be covered outdoors is known. The equation is 1 watt per 1000 square feet. For indoor voice coverage, the factor of 1 watt per 25,000 cubic feet may be used for normal voice levels up to 85 db. It has been found through experience, that it is impracticable to use this factor, even in carefully engineered systems, where the ambient noise level is above 85 db. If it is necessary to cover a high ambient noise level, careful consideration must be given to the noise frequency range, the noise level, and the type of acoustics of the room.

For music reproduction, the public address system becomes more of a precision instrument. For normal good reproduction, a band of 120 to 5000 cycles is considered good commercial practice. The combined width may be extended from 75 to 8000 cycles if good acoustical and low noise level conditions exist where the sound is to be reproduced. In industrial installations

this type of reproduction is not practical and no benefit is derived from the added cost of the wider band.

The combination of music and voice reproduction for industrial installations is the most common type of system. Unfortunately, this is a compromise because the added low frequency response for music reproduction that is built into the system decreases the understandability, or articulation, of the system for paging. It is a common fault, when installing systems to make the music sound good

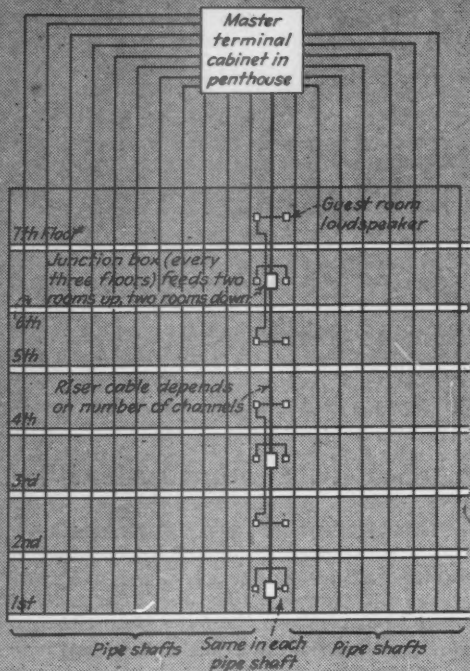
and to forget about the voice. In the better industrial installations special equalized pre-amplifiers are used to minimize this effect so that when voice is reproduced, maximum accent is put upon the voice frequencies, and when the system is used for music, proper equalization is used to obtain the best music reproduction possible.

In selecting equipment for the industrial system, it is customary to include a good AM-FM radio receiver to tune in local programs, a good automatic phonograph that plays inter-



*Central amplifier control room for hotel public room and sound installation. Equipment consists of three fifty watt power amplifiers fed by twelve microphone pre-amplifiers. Patching facilities available in rear of amplifier racks for connecting microphone sources to any of pre-amplifiers. At left—Speaker control cabinet with adjustable speaker level controls, and patch cords for connecting speaker systems to the output of any of three power amplifiers.*

# TYPICAL VERTICAL WIRING DISTRIBUTION HOTELS



**Complete system feeds three public rooms and a foyer. Complete system engineered and fabricated by Langevin.**

mixed standard 10 inch and 12 inch phonograph records, and a control box with a microphone to be located next to the switchboard that automatically reduces, or cuts out, the radio or phonograph program, when the microphone is used for paging. Careful attention should be paid to the type of equipment selected. In many industrial plants conditions exist inside of the building that present a greater moisture-proofing problem than some outdoor installations. Some equipment locations have to be protected from high ambient temperatures, and some from mechanical damage such as overhead cranes.

The location of the amplifying equipment may be simplified by placing it in a central location and feeding distribution wires to all of the speaker locations. For the most dependable type of installation, all speaker lines should be run in conduit or EMT, using a No. 12 wire for the main distribution feed, and a No. 14 wire for the individual speaker feeds. Since the signal voltage of a properly designed system seldom exceeds 100 volts, it usually does not fall into the Fire Underwriter's Specifications, but it is always advisable to follow code practices in the installation.

**Inside wiring of loudspeaker control cabinet showing cable run by the electrical contractor emanating from cable conduit directly above the cabinet. All contractors wiring was run to two terminal strips located in the bottom and near side of the control cabinet.**

The microphone circuit, between the switchboard room and the amplifying equipment, should be run in conduit and should be No. 22 twisted pair with a braided shield and a cotton, or plastic, braid overall. If at any time this circuit should drop below the ground line of the building, or should run outside underground, it should be insulated with No. 14 duplex lead.

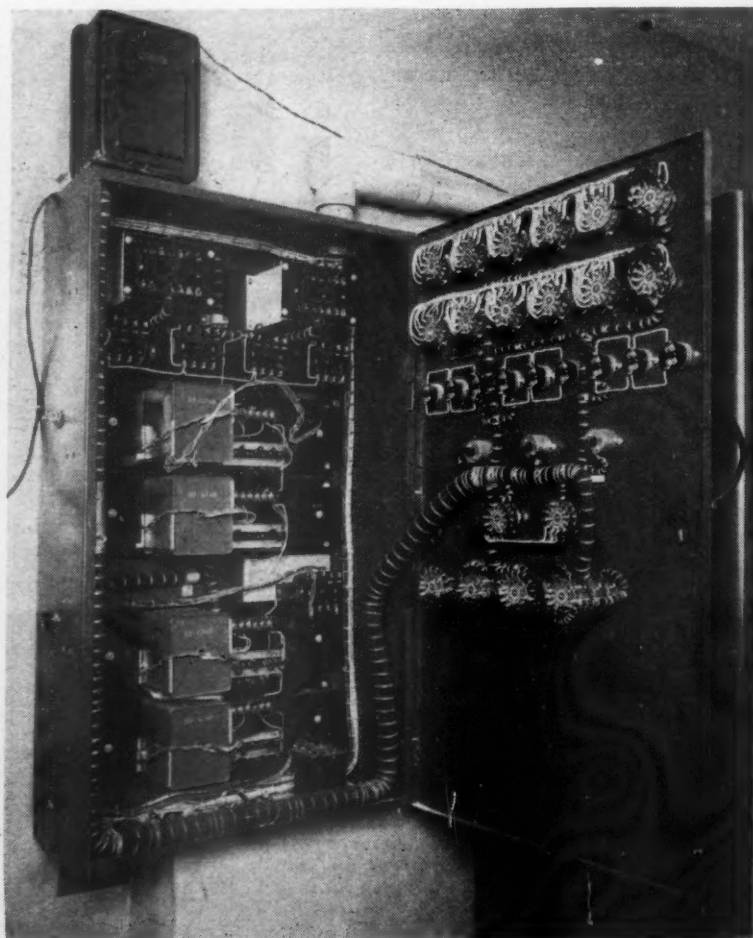
The a-c requirements for a properly designed industrial system will be maximum during the time of operation only, and will require only about 25 percent of the total power during the stand-by period. For stand-by operations, it has been found that longest tube and equipment life can be expected if the applied voltage to the equipment is reduced to 50 percent of its rated value. This keeps the equipment hot for immediate use and greatly reduces the power and strain on the equipment when not in use, and is recommended as a good system.

## Hotel Systems

In hotel installations, the voice reproduction equipment is only used in the lobbies and service sections for paging. This type of a system usually

entails a single microphone, usually at the Bell Captain's desk, with a small amplifier located nearby. The amplifier, in most cases, is on continuously and feeds a small group of speakers properly placed around the lobby. If other areas are to be covered, special consideration has to be given to the size of the area, and noise levels, and will require special design.

The music system for hotels usually is a public address system in the main dining room, ball room, cafe lounges, etc. This type of system usually ranges from a single, quality microphone, and a small amplifier with several high-grade speakers to a very complex system which requires up to six or eight microphones and is capable of supplying local broadcast stations with a feed at the same time feeding wide range speakers that are properly installed in the room. A large number of microphones are necessary in the larger banquet rooms to take care of round-table discussions, or special occasions when the speaker's table is located at one end of the room and the entertainment is provided at the other end. The availability of several microphones enables





the operator to switch from one section of the room to the other without leaving his control position. The amount of audio power for each ball room should be at least 50 watts with a complete spare unit for stand-by purposes.

The guest room system of a hotel consists mainly of a program source such as a radio receiver or a telephone line to the local broadcasting station and a power amplifier to feed high level signal into each room. The amount of audio power required per channel may be estimated by allowing approximately 1/10 watt per room to be served with a minimum of a 50 watt amplifier for good reproduction. The number of channels usually installed is four, allowing a program selection of four major radio networks. In larger, metropolitan areas, the trend is toward six channels—five of the channels to supply radio programs and the sixth channel to be used for special purposes, such as local programs or programs of special interest that do not appear on the local channels. Each guest room is equipped with a small high-quality loudspeaker, a channel selector switch, and volume control. This entire assembly is usually custom built into a standard piece of equipment such as a night table, or built into the wall. From a service standpoint, less maintenance is required for the wall type installation, but greatest guest comfort is provided with the bedside installation where the guest may select his program while resting in bed. Both types of installations are in common use, and a choice depends upon the taste of the hotel management.

The installation of the guest room system may be divided into two types of distribution systems. First, vertical distribution. The main distribution feed is run vertically in the pipe shafts, and on every third floor a junction box is installed that feeds six rooms—two rooms up, two rooms down, and two rooms on the same level. The junction box in the pipe shaft has to be of good drip-proof construction because moisture, normally found in pipe shafts, can cause serious cross-talks, interference, and shorts if permitted to come in contact with the terminal strips.

Second, horizontal distribution. This is a type of system where there is only one vertical feed and each floor has an individual take-off. All the rooms on that floor are served from that one junction box. This type of

installation is usually more expensive and is used only in new installations where conduit may be installed during construction. Maintenance on this type of system is difficult because the speaker circuits run from one room to the other on the same floor and thereby the number of potential points of trouble are increased. The type of wire to be used in this installation is usually shielded, twisted pair or a concentric type of cable with a Vinylite, or similar synthetic rubber jacket. The type of outer insulation is very important, as heretofore mentioned, for protection against moisture.

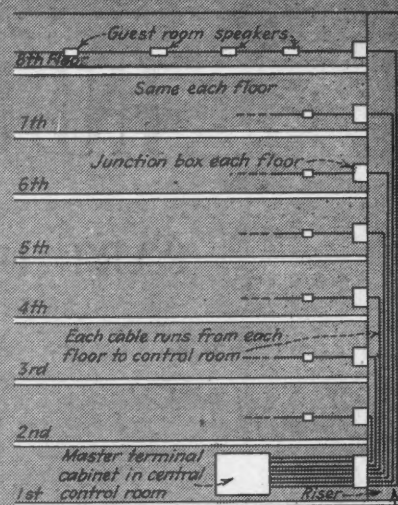
The recommended location of the amplifier room is on the top floor of the building. This simplifies installation, puts the radio receivers close to the antennas on the roof, and places the amplifiers in a position for good distribution to the pipe shafts for either vertical or horizontal distribution. A convenient feature is to include a time clock in the power circuits so that the entire system can be turned off at midnight and turned on again in the morning. This reduces the checking of the system, except for routine checks on the tuning and the volume of the receivers, to a minimum of at least once a day.

In large hotel installations, it is highly recommended that all public address equipment for hotel public rooms be located in the same central amplifier room as the guest room equipment. This enables one operator to keep a watch on all of the radio and audio equipment and at the same time, it makes equipment, not in use, available for substitution for defective units. The larger hotel chains have standardized on this type of centralized operation.

#### School Systems

School system installations are very similar to hotel installations. Each school room usually requires approximately  $\frac{1}{3}$  watt of audio power and a good 10 inch loudspeaker. The central control equipment consists of a radio, automatic phonograph, and a microphone with a complete switching panel so that each school room has an individual switch that may be connected to one of the two amplifiers usually provided, or a talk-back amplifier, so that the operator may talk or listen to any room in the school. Since the talk-back feature is a must with every school system, precautions against cross-talk must be observed.

TYPICAL HORIZONTAL WIRING DISTRIBUTION HOTELS



Contractors wiring consists of wiring between racks and to a terminal board in the bottom of Rack #1.

This means that each room should be served with a shielded, twisted pair from the room to the control cabinet. If the talk-back feature is not important, a multi-conductor or intercommunication type of cable may be used.

Modern school systems are usually complete units within themselves, thus simplifying the installation. Many schools desire special features, such as separate public address systems for football fields, gymnasiums, auditoriums, and cafeterias. Each one of these systems must be considered separately, as any alterations to the basic school system complicates the switching and should not be attempted without consultation with the manufacturer of the equipment. Many school systems are now installing an electric clock along with a speaker in the same cabinet in each room. This requires careful installation as it involves a 110 volt a-c clock circuit and increases the fire hazard if not properly installed.

The acoustic conditions of the average school room are very good, and the best installation of the speaker is in a front corner of the room. This gives the most satisfactory acoustical coupling of the loudspeaker to the room.

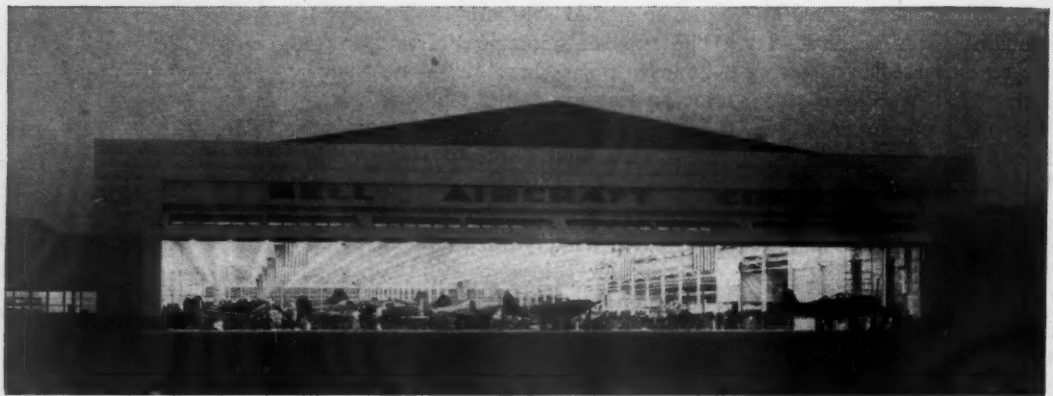
#### Amusement Systems

Amusement systems cover a wide range of public address installations. This type of installation varies from a simple, portable, bally-hoo system

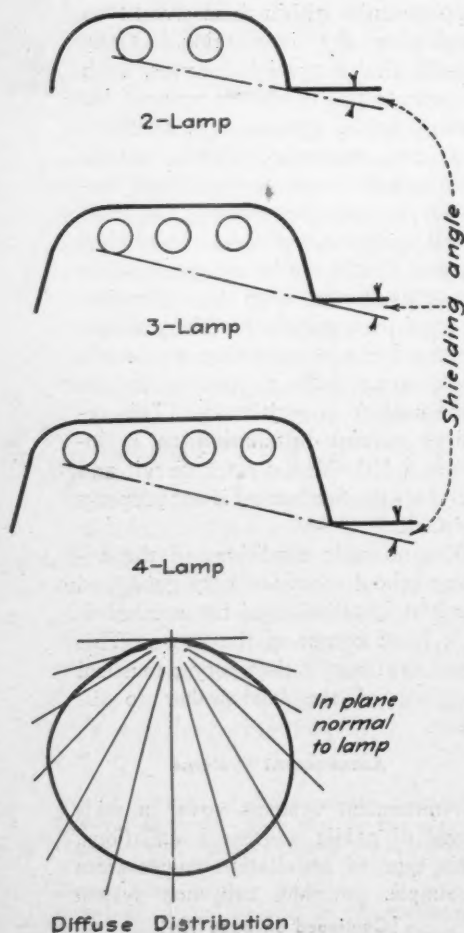
[Continued on page 154]

# INDUSTRIAL LIGHTING

## PART II—Lighting With Fluorescent Lamps



*Bell Aircraft's Niagara Falls assembly plant is typical of 1941-45 war production plants. Full production efficiency was maintained at all times, bright days or dull, one shift or 24-hour day basis, with high level lighting using fluorescent lamps and equipment.*



**T**HE fluorescent lamp was first announced to the general public at the New York World's Fair in 1938. Its underlying principles of operation were discovered by Thomas A. Edison late in the 19th century. Its final development to the stage of practical use was an outgrowth of research in connection with mercury vapor lamps of the high intensity type, brought into popular use during the 1930's.

First concepts of the application of the fluorescent lamp were its use as a colored light source, since the efficiency of the fluorescent lamp in producing colored light, especially green, is very high. Researchers, however, recognized the possibilities for producing "white" light efficiently with this new type of electric discharge lamp, and set out to develop phosphors for this purpose. Within the first few months of the announcement of this light source, lamps which would produce "white" light were in production. These lamps provide about double the light output per watt compared with

*Typical industrial reflectors and lamp arrangements. Light distribution from porcelain enameled steel, baked white enamel finish, or aluminum is diffuse, approximately as shown. Shielding angle is usually 12 to 15 degrees.*

standard incandescent lamps, in a range of color temperatures to meet varying requirements for lighting in industry.

The quick acceptance by the public of this new light source was unprecedented in any industry. Within the first three years after its announcement, lamp and lighting equipment manufacturers reached an annual volume on fluorescent lamps and lighting equipment for these lamps estimated at approximately one hundred million dollars. This phenomenal growth was checked by War II, due to restrictions on production in the interest of conservation of critical materials needed in the war production program. Fluorescent lighting techniques continued to progress during the war, however, as priorities were given to war plants to enable them to make efficient use of light as a production tool. Comparison studies between various lighting methods based on various light sources showed economies in power consumption for light produced by fluorescent lighting systems. Further economies in the use of critical materials were effected by government restrictions on the use of metal in fluorescent lighting equipment. Plant and lighting engineers responded quickly by devising new and ingenious



# NG TECHNIQUES

By Berlon C. Cooper

## A discussion of lighting equipment and lighting layouts for industrial plant illumination when fluorescent lamps are used.

lighting layouts to meet the various restrictions imposed. Thus was progress made in fluorescent lighting techniques during the critical war years.

### Fluorescent Lighting

Termination of the war in 1945 has added new impetus to fluorescent lighting research. New sizes and shapes of fluorescent lamps have already been announced. Equipment manufacturers have developed new reflector shapes and maintenance features, and adopted new production techniques learned during the war. Many new developments have been announced, and others may be expected.

The fluorescent lamp is a line source. Since the diameter of the lamps ( $\frac{3}{4}$ -inch to  $2\frac{1}{2}$ -inches) is considerable compared with the point source of incandescent lamps, the light cannot be controlled as accurately with reflectors or refractors, and lighting units inherently produce a diffuse distribution of light. Specular reflectors and prismatic lenses used with the small diameter tubes offer a fair degree of control, however, which is adequate for most industrial applications. Typical units with wide distribution of light are ideal for general lighting throughout production areas in industry.

A relatively small number of fluorescent lamp sizes (length, diameter and shape) now meet a wide range of lighting requirements when combined with the proper type of reflector equipment. The popular sizes of these lamps are available in four "white" lamps for industrial use. A choice of colored lamps is also available in many sizes. Light output varies from about 35 to 65 lumens per watt for the "white" lamps, depending on the "color", the length and diameter of the tube, and other similar factors.

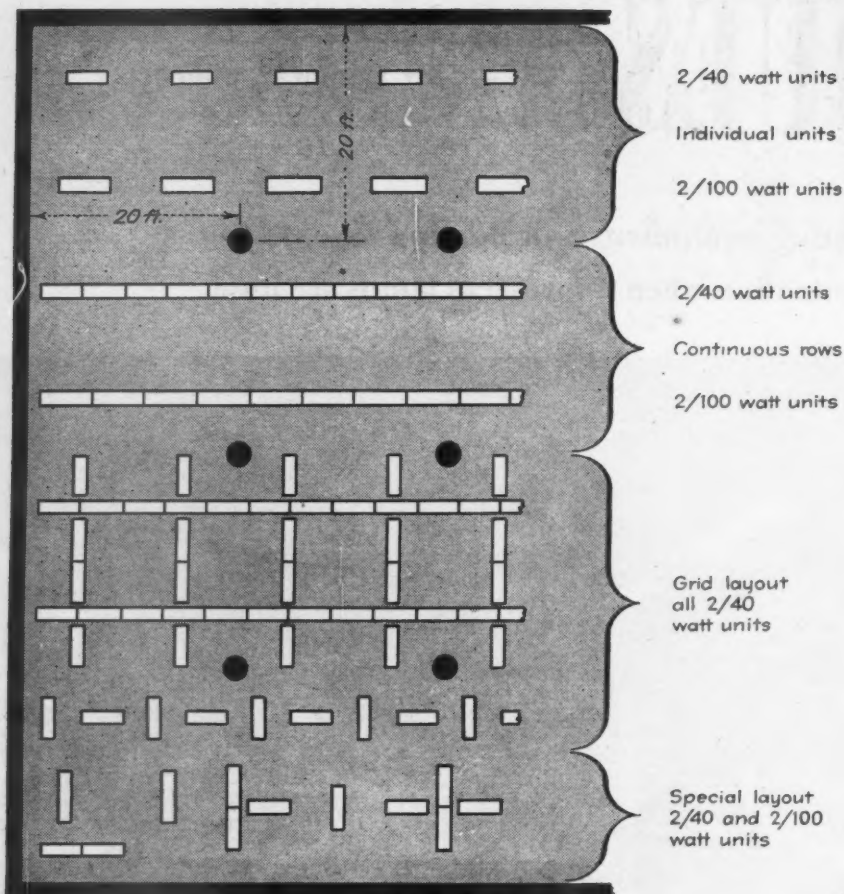
The cold cathode segment of the fluorescent lamp industry has made some progress toward standardization of lamp sizes, and a few fixture manu-



Individual units each using two 100 watt fluorescent lamps in closed end porcelain enameled steel reflectors were used to light this defense plant machine shop to an average intensity of 40 footcandles.

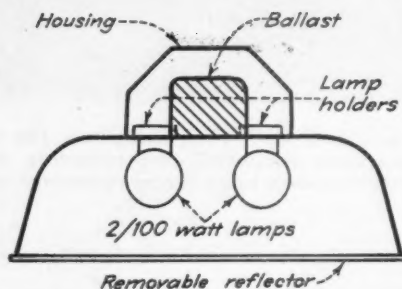
High intensity local lighting can be obtained with fluorescent units, either individual or continuous row, as is done in this radio assembly plant. Two-lamp 40-watt units installed over benches supplement the general overhead lighting.





**Fluorescent lighting layouts for general illumination are usually of the individual unit symmetrical spacing, continuous row mounting, or grid layout. Special layouts are sometimes used when directional control of light is advantageous.**

**Cross section of typical industrial reflector unit, showing component parts. Starter switches are required for non-instant start ballasts.**



facturers are making reflector units for these lamps. The popular size at present for industry is an eight foot lamp, and reflector units are designed to accommodate either two or four of these lamps, installed side by side.

Lamp life is high for fluorescent lamps, but is affected to considerable extent by the number of times turned on and off. Life varies from 2500 hours for frequent starts to over ten thousand hours for cold cathode lamps started infrequently. Lamp life, lumen output and other technical data on fluorescent lamps are readily available from all manufacturers, hence will not be reviewed in greater detail here.

**Lighting Equipment.** There are two broad classifications of types of fluorescent lighting units for industrial application: 1) units for general light-

ing; and 2) units for local or specific lighting over machines, or specialized work areas. A fluorescent industrial unit consists essentially of a reflector, fixture body or housing, ballast or transformer, lampholders, wire, hangers for suspension type units, and starter switches and sockets for units of the non-instant starting type. Reflectors for general lighting are usually porcelain enameled steel, baked-on enamel on steel, or diffuse finish aluminum. During the war reflectors were made of wood (Masonite) and finished with baked-on white enamel. These proved quite satisfactory as a substitute during the war period, but were found to warp and become brittle, and were more expensive than metal reflectors.

Three sizes of units solve most gen-

eral lighting problems in industrial plants. These are the four foot, five foot and eight foot long units. The four foot units use two, three or four 40 watt lamps. The five foot units use two 100 watt lamps. The eight foot units use two or four cold cathode type lamps in each eight foot length, or four, six or eight 40 watt lamps of the hot cathode type.

There are a wide variety of types of units for special lighting applications, ranging from small portable 4 watt units to large inspection hoods using a number of 40 watt or 100 watt lamps. Some of these use special shape and size reflectors, usually specular or semi-diffuse finished aluminum, to provide either concentrated or intensive distribution, either symmetric or asymmetric in shape. One manufacturer makes an explosion-proof two lamp unit, and several manufacturers produce enclosed dust tight and vaporproof type units for use in extremely dusty or semi-hazardous locations.

**Light Distribution.** Typical units for general lighting provide a diffuse or wide spread pattern of light in a plane normal to the lamps. Special units for localized lighting provide various patterns of light distribution, depending on the shape and contour of the reflectors.

Since typical industrial reflectors have a normal wide spread distribution of light, they provide fairly uniform lighting intensity when spaced on centers equal to or less than their mounting height above the work plane.

**Special Applications.** Wide variations in lighting requirements for industry demand special techniques for lighting many machines and seeing tasks. Inspection areas, for example, require special treatment. Inspection of large metal sheets can be accomplished efficiently with large area, low surface brightness hoods. Small metal parts can be inspected easily under high intensity well diffused direct light which provides a degree of specular reflection, and quickly shows up flaws and imperfections.

Hazardous locations present a difficult problem in lighting. One solution is the use of explosion-proof lighting units installed in the hazardous area. Many such areas are lighted from without, using standard equipment installed behind glass plates gasketed into the ceiling or side walls. Some units used for this purpose are enclosed gasketed units, equipped with a com-

[Continued on page 156]



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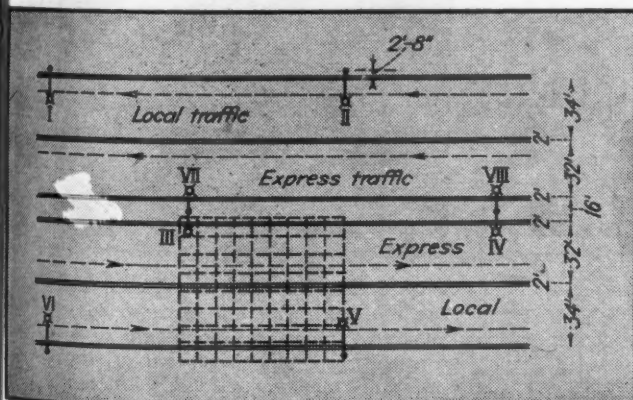
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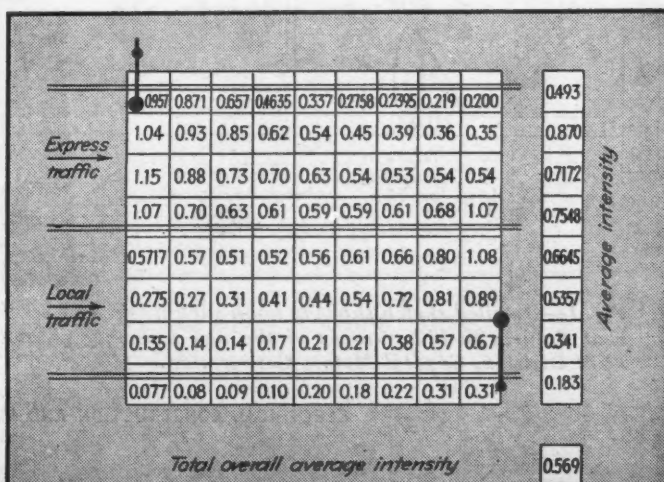
at 10-foot intervals. This cross-sectioned area, 100 feet longitudinally by 80 feet transversely, contained 80 squares. Lighting units were arbitrarily positioned on this plan with twin-lamp standards located in the center island and single-lamp units

The highway plan was superimposed upon the isolux chart and recordings were made of the footcandle intensities in each square. Eight

*Small section of highway plan, between center island and outer curb line, is divided into 10-foot squares. Combined lighting intensities from eight luminaires result in values indicated.*



**Typical section of highway shows design of traffic lanes and location of lighting units. Eight luminaires contribute light increments to all locations.**



BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

# Practical Methods

## Hook-Stick Aids Catwalk Servicing

MAINTENANCE

Specially designed hook-sticks will be used to service hi-bay fluorescent fixtures in the new assembly plant of the Chevrolet Flint Division of the General Motors Corporation. Designed by Albert Kahn Associated Architects & Engineers, Inc., project architects, and installed by the John Miller Electric Company, Detroit electrical contractors, the scheme provides a simple economical method of hi-bay lighting maintenance. It is applicable to any system where service catwalks are installed and fixtures are "plug-connected" to circuit conductors.

The fluorescent units, as indicated in Fig. 1, are suspended from messenger cable assemblies running the full length of the monitor bay. Six rows of fixtures (two 100-watt lamps per unit) are mounted on 10-ft. centers in the 60-ft. width of the bay. Three catwalks installed in the trusses each give access to two rows of units (one row on each side of walk). Branch circuit conduits, with a receptacle outlet at each fixture, are mounted direct to the messenger. Fixture hangers are suspended from the conduits.

To permit catwalk servicing, each

fluorescent unit is equipped with specially designed supporting rods and electrical connections. The two rods on each unit (each 2-ft., 9-in. long) have an elongated eye or loop which fits over the conduit and permits 90-degree rotation to catwalk position. Electrical connection is by a flexible cord with a plug on each end—one for the conduit receptacle, the other for the fixture. Fastened to the top of the wiring channel—and at the center of each fixture—is a "lifting clip" made of  $\frac{3}{8}$  in.  $1\frac{1}{2}$  in. steel with a 1-in. hole to accommodate the hook-stick.

To hoist the fixture into maintenance position, the electrician uses a wooden stick with an elongated "S" hook attached to the bottom (overall length of hook-stick is 4 in. 0 in.). The small bottom hook is inserted in the fixture "lifting clip"; the larger upper hook fits over the top guide rail of the catwalk. With the fixture in this position, one edge of the RLM reflector rests on the intermediate rail of the catwalk fence". Lamps and starters can be easily changed, or the unit washed in this position. If socket changes or repairs are necessary, the cord connection can be broken at the fixture, guaranteeing safety of the maintenance man.

Designers expect this method to effect a considerable reduction of lighting maintenance man-hours.

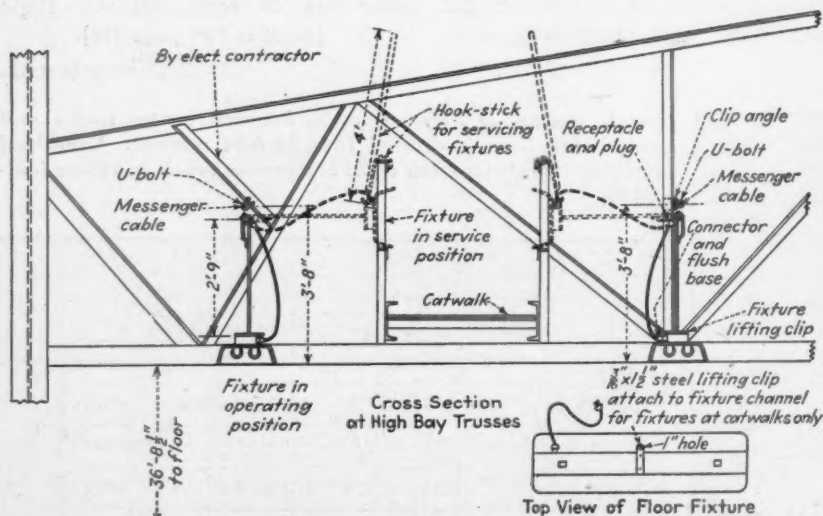
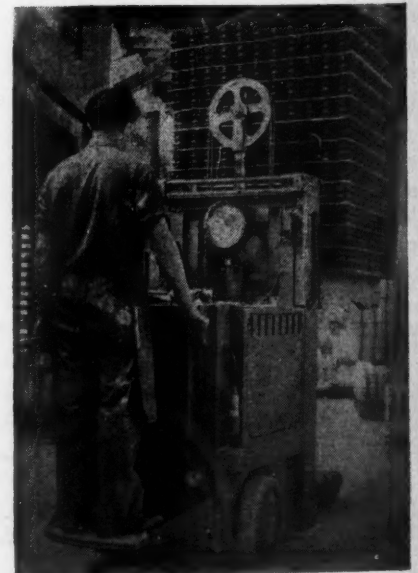


Fig. 1—Detailed sketch showing hook-stick method of servicing fluorescent fixtures in hi-bay areas of the new assembly plant of Chevrolet Flint Division, General Motors Corporation.

## Industrial Trucks Reduce Breakage

INDUSTRIAL

Production losses by manual handling of shiny-smooth ceramic insulators were largely eliminated in the Le Roy, N. Y., plant of the Lapp Insulator Company, Inc., through the use of battery-powered industrial trucks. Telescopic platform electric trucks with capacities of 4,000 lbs. lift skid loads of nearly 1,500 porcelain insulator spools for 2,300-4,000 volt distribution lines. In transporting insulators from one operation to the next, the trucks ride smoothly on rubber-tired wheels. Trucks are equipped with indicating dial to permit operator to judge safe loading, with elevating mechanism for facility in loading or storing and with controls for exact maneuvering of truck in crowded areas. Smooth acceleration reduces vibration to a minimum and makes it possible to handle products with safety.



With indicating dial to register loading and with convenient controls for regulating acceleration, height of lifting platform and movement of truck, operator transports load with minimum damage. Production losses have been substantially eliminated since trucks replaced former manual handling of smooth-surfaced products.



# Cable Suspension of Fluorescent Fixtures

WIRING

Two methods of suspending long rows of fluorescent fixtures from steel structures find wide application in industrial plants today. One is to mount the units to a network of angle-irons fastened to the roof trusses. The second—and more common—method of using messenger cable suspension was specified by Albert Kahn Associates Architects and Engineers, Inc., Detroit, for the lighting system at the new Chevrolet Flint Assembly Plant of the General Motors Corporation.

John Miller Electric Company, Detroit electrical contractors on the job, encountered three distinct mounting conditions: (1) suspension from concrete ceiling slabs; (2) suspension from slanting members of steel roof trusses; and (3) low-level mounting from high monitor bays.

In the ceiling slab areas, hanger inserts were installed in the forms parallel to the main reinforcing rods. These accommodated messenger cable suspension rods (Fig. 1). On slanting truss members, wedge-washers were used to keep the suspension rods perpendicular. Where low-level mounting (16-ft., 5-in. mounting height) was desired in high bay areas, long suspension rods (24-ft. and 30-ft. length) were installed with  $\frac{3}{8}$ -in. messenger cable sway braces at the column lines (Fig. 2), at fixture level.

In all cases, the messenger cable supported the branch circuit conduits equipped with a twist-lock grounded receptacle at each fixture location. With the exception of those in catwalk serviced areas, all fixtures (RLM fluorescent units with two 100-watt lamps each) were suspended from the conduits by short metal strap hooks (Fig. 1). For quick maintenance the fixture plug is simply disengaged and the unit lifted off its conduit support.

Considerable thought was devoted to dead-end termination of messenger cables on the trusses at the column lines. Main problem was to keep the cable sufficiently taut to prevent sag under the weight of the fixtures (mounted on approximately 8-ft. centers) with resultant strain on conduit connections. Figure 3 illustrates the method used for the  $\frac{3}{8}$ -in. messenger cable on each row of units. Turnbuckles and clevises were used on both the fixture suspension and strain cables. To prevent weakening of structural members by punching and drilling, special angle-iron brackets were mounted to the trusses.

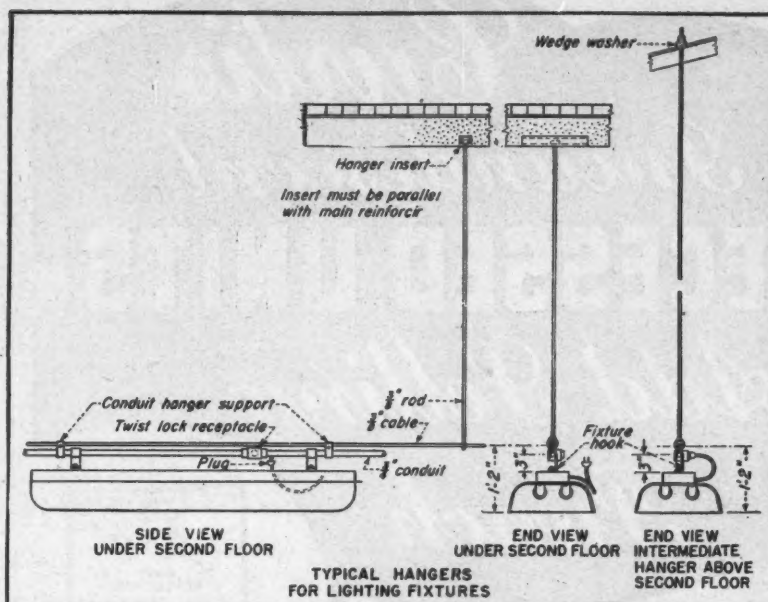


FIG. 1—Typical hanger designs for suspending messenger cable and fluorescent fixtures at the new Chevrolet Flint Assembly Plant. Note quick-maintenance feature of fixture suspension.

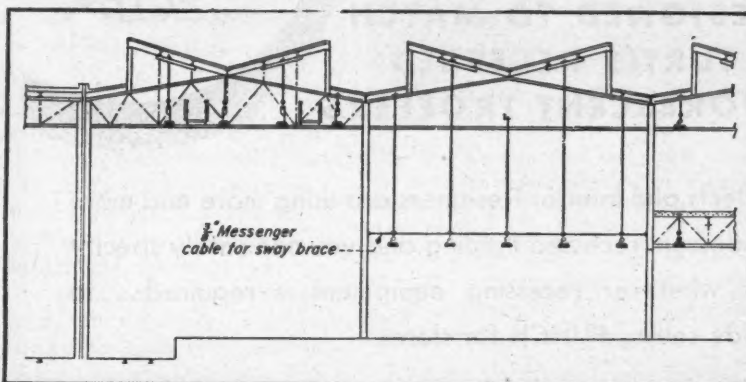


FIG. 2—Unusual, special low-level suspension of fixtures from high monitor bay requires messenger cable sway bracing at column lines. At several locations conduit cross-feeds replace the messenger cable.

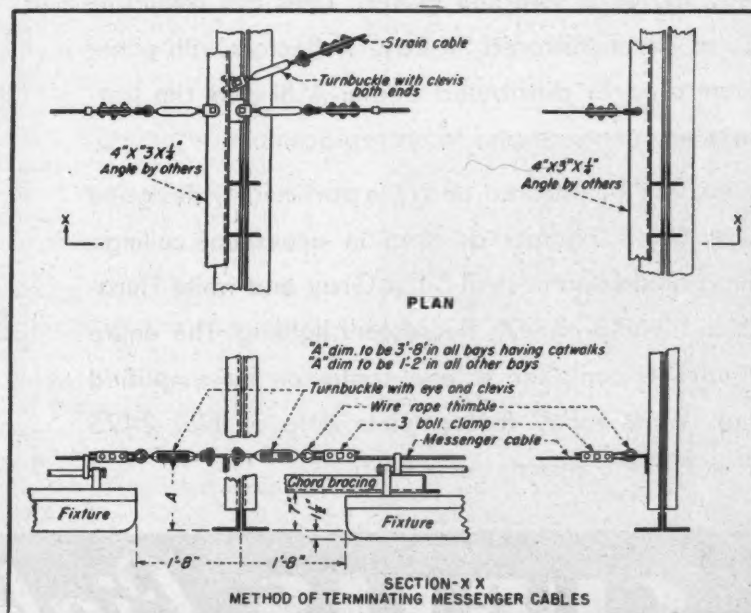


FIG. 3—Details of messenger cable terminations at column lines. Note effective use of turnbuckles to keep fixture suspension and strain cables taut.

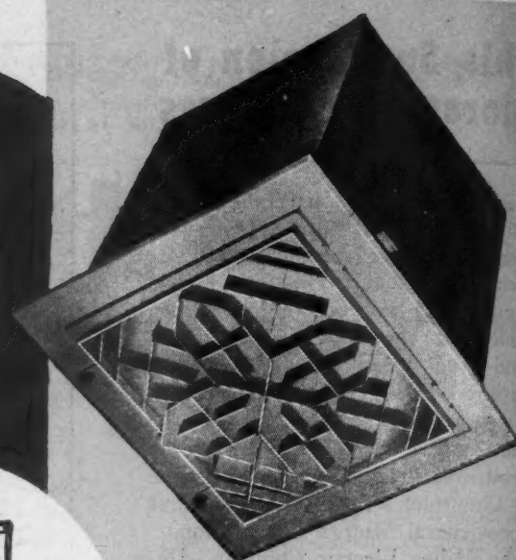
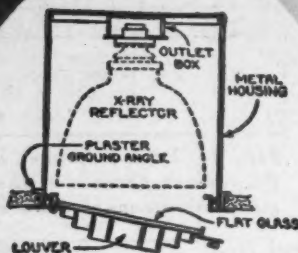
# Curtis Incandescent RECESSED UNITS Add Selling Punch

## DESIGNED TO MATCH CURTIS RECESSED FLUORESCENT TROFFERS

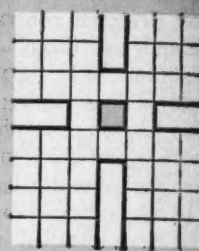
Architects and Interior Designers are using more and more incandescent recessed lighting and you can safely specify Curtis wherever recessing equipment is required...to provide selling PUNCH for stores.

These incandescent units are available with Square or Circular ceiling rims. In either style, they can be furnished with lens, louver or lens and louver. Units are available with Curtis Silver-Mirrored "X-Ray" Reflectors with either a concentrated or distributed beam. A hinged rim permits easy maintenance and lamp replacement.

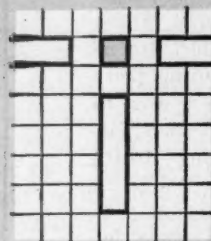
The No. 2495 illustrated above is particularly designed to match Curtis Troffers as used in acoustical ceilings. This unit is finished in neutral Satin Gray and white Fluoracite which blend well with fluorescent lighting. The entire unit is packed complete in one container for simplified handling. Write today for complete data on No. 2495 and other Curtis recessing equipment.



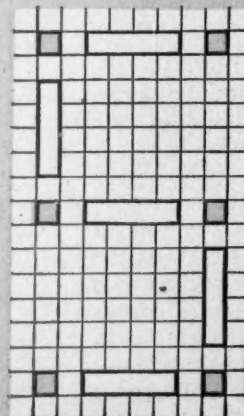
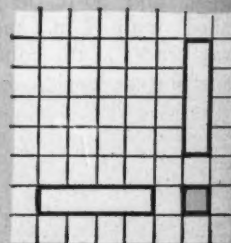
Where architectural arrangements require "T" formations, the No. 2495 meets the situation perfectly.



No. 2495 forms many interesting ceiling patterns. Permits a perfect center for transverse and longitudinal lines.



Ideal for right-angle turns or for following wall contours with continuous lines of light.



The "S" pattern is another one of the many ceiling patterns possible with No. 2495 to follow established floor arrangements with punch lighting.

# CURTIS Lighting, INC.

6135 WEST 65TH STREET, CHICAGO 38, ILLINOIS



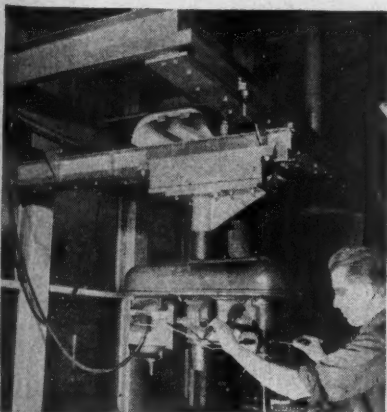
## Drill Press Head On Mobile Suspension

SHOP

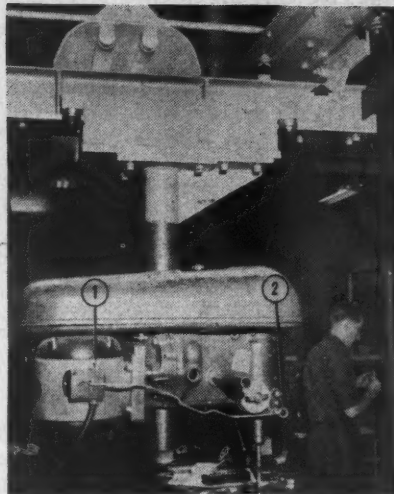
Like all organizations with machine shop facilities, Kirkhof Electric Co., Grand Rapids, Mich., utilized its "know how" and shop equipment for assembly work during the war. Mass production techniques employed led to the development of numerous time-saving ideas which were carried over to its present switchboard, control board and electronic device assembly work, a prewar and postwar adjunct to its motor repair and electrical construction activities.

From the standpoint of general shop work, one of the most useful developments was the design of small bridge-crane suspension for the head of a conventional Delta drill press (Fig. 1). The device permits forward, backward and lateral positioning of the drill and enables an operator to make all necessary drillings on the face of a control cubicle panel section with a single setup. Instead of positioning the work, the operator moves the drill. The same technique is applied to the mass production drilling of copper busbars, metal enclosures for electronic equipment, pull and splice boxes, strap hangers and similar wiring accessories.

The rectangular supporting frame consists of 6-in. I-beams (three sides) welded to an 8-in. channel on the wall (bridging three windows) and suspended from the ceiling by three steel posts. Bolted to the underside of the lateral I-beams are  $\frac{1}{2}$ -in. steel plates which form the "rails" on which the movable bridge rides.



**FIG. 1—**Miniature bridge crane assembly increases flexibility of conventional drill press; permits operator to position drill instead of work. Designed by Kirkhof Electric Co., it is used extensively for drilling panels for control cubicles. Device provides 48-in. back and forth travel; 120-in. lateral travel. Drill chuck (top position) is 9-in. from work table.



**FIG. 2—**Closeup of bridge and trolley showing anti-sway bearings (bridge) mounted on eccentric shoulder bolts for accurate adjustment (heavy arrows); bench light control switch (1) and remote control lever for motor (2). Drill press head can be quickly removed from trolley post and replaced on original pedestal.

The "bridge," fabricated from a section of 5-in. I-beam, also has a steel plate "rail" on which the drill head trolley rides. Carriage plate assemblies near the ends each have six  $1\frac{1}{4}$  in. ball bearing wheels. Two of these support the bridge and ride the top of the rail. Of the remainder acting as anti-sway devices, one rides the underside of the rail, two the outer edge and one the inner edge (see heavy arrows, Fig. 2). Full lateral travel of the bridge is 120 inches.

The "trolley" has a similar anti-sway design with each side plate having six bearings, two of which ride respectively the top, bottom and edge of the "rail." By mounting bearings close to the ends of the plates, all side-sway is eliminated. Accurate adjustment of the anti-sway bearings is accomplished by the use of eccentric shoulder bolts. The drill post assembly, made from a section of  $3\frac{1}{2}$ -in. pipe, is bolted to the underside of the trolley.

A wire rod lever attached to the switch on the motor frame permits the operator to control the motor at the drill chuck. Also located on the motor switch box is a toggle switch for the fluorescent unit mounted in the center of the supporting frame. Good lighting is provided on the work surface by the two 100-watt, 3500-degree white lamps in the fixture.

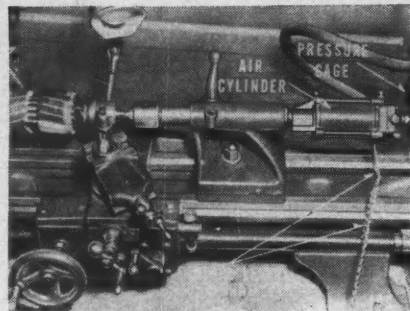
If desired, the drill press head can be quickly taken off the crane assembly and replaced on its original pedestal. Electrical connection in both instances is by flexible rubber cord and disconnect plug.

## Air Operated Tail Stock

INDUSTRIAL

Turning commutators has been simplified at the Westinghouse Small Motor Division, Lima, Ohio, through the use of an air operated tail stock, mounted on the lathe used for this work.

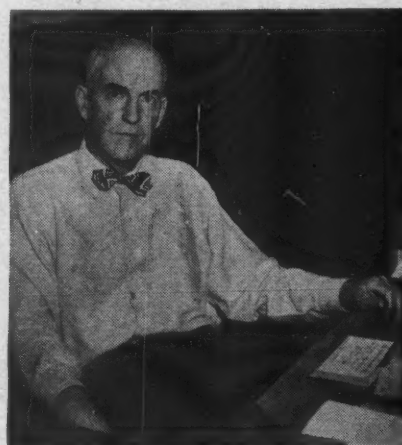
A lever and chain on the air cylinder control valve (Fig. 1) are connected to a foot pedal. Pressing the foot pedal releases the air and causes the center to withdraw, allowing the removal of the armature from the lathe. Releas-



**FIG. 1—**Air operated tail stock simplifies turning commutators in Westinghouse Small Motor Division plant, Lima, Ohio.

ing the foot pedal causes the air to enter the cylinder and move the lathe center forward to hold the armature with a uniform air pressure.

A gage (extreme right in Fig. 1) gives the operator a constant check on air pressure. This setup leaves both the operator's hands free to handle the armature while placing it in or taking it out of the lathe, and reduces the manual labor used in moving the center back and forth.



**F. M. Hydon, Hydon-Brand Co., Detroit, in his new office at 546 E. Larned Street. Moving into the new building was one way of celebrating the firm's 25th Anniversary as specialists in the industrial electrical construction field.**

# CONFIDENCE.



Manufacturers of Wire Rope and Strand • Fittings • Slings • Screen, Hardware and Industrial Wire Cloth • Aerial Wire Rope Systems  
Hard, Annealed or Tempered High and Low Carbon Fine and Specialty Wire, Flat Wire, Cold Rolled Strip and Cold Rolled Spring Steel • Ski Lifts

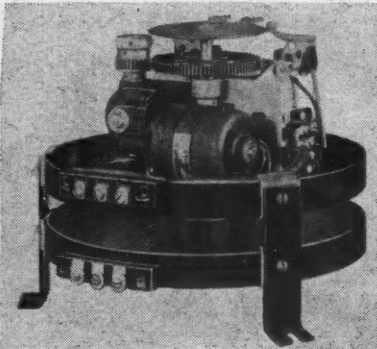


THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising department, tell them in what issue of **ELECTRICAL CONSTRUCTION** and **MAINTENANCE** you saw the item and they will send full details to you.

# Equipment News

## Motor Drive

This small motor drive unit is designed for remote and automatic operation of single or multiple steel rheostats controlling generator voltages, motor speeds, lamp intensities, and numerous other rheostat applications. Available for a-c and d-c 115 or 230 volt operation, supplemental Bulletin 60A motor drive units are suitable for control of 13-inch SS rheostats up to three plates. Standard units have 30 or 60 seconds travel from the "all resistance in" to the "all resistance out" position but can be furnished for shorter or longer travel time. These drives are intended for mounting on extended rheostat feet. Ward Leonard Electric Co., 31 South Street, Mount Vernon, N. Y.



WARD LEONARD MOTOR DRIVE

## Vertical Induction Motor

A new hollow-shaft vertical motor designed specifically for pump drives has been added to the line of Tri-Clad induction motors. Available in ratings from 1 to 500 hp. all speeds and frequencies, the new motor is suitable for use on irrigation projects, deep - well turbine pumps, municipal and industrial water supply projects, mine-de-watering pumps and process - industry liquid pumps. For motors rated 10 hp. at 1800 rpm. and larger, the new line features a system of controlled lubrication which allows just the right amount of oil to flow through the bearings. Bearings, punchings, and windings are cooled by a double end ventilation system which draws in air at both ends of motor and discharges it through openings in the stator frame. Rotor windings in all ratings provide suitable starting torque with the low starting current need for full-voltage starting. General Electric Co., Schenectady, N. Y.



G-E VERTICAL PUMP MOTOR

## Fluorescent Fixture

A new line of commercial fluorescents, called Light-In-Line, has been announced. The line consists of four standard base strips for open lighting, which combine with louvred attachment or glass and plastic enclosures. This engineered use of the basic unit principle makes possible a complete range of commercial lighting in two and four light, 40 and 100 watt, adaptable for single or continuous row application, flush or pendant mounting. Some of the advantages claimed by the manufacturer are the two component parts design making installation by one man easy, as bases are mounted first and enclosures are hung on and closed up with thumb screws, giving quick access to lamps and starters for maintenance. All are capable of being converted to instant start without changing ballasts. Moe-Bridges Corp., Sheboygan, Wis.



MOE-BRIDGES LIGHT-IN-LINE

## Safety Switch

Front operated general duty safety switches are now available with the newly developed heavy duty toggle type switch. They can be used where space is limited and are suitable for many types of residential, commercial, rural and industrial electrical installations. Features are snap-action, double break type mechanism, with self-aligning blade; extra heavy gauge current carrying parts to perform at the full rated 30 ampere capacity; large toggle type lever. Cabinet is large enough to permit wiring without removing interior mechanism. The Wadsworth Electric Mfg. Co., Inc., Covington, Ky.



SAFETY SWITCH

FOR SAFETY'S SAKE . . . USE CONDUIT (*Full Weight Rigid Steel*)

# HIDING the Wiring

*doesn't make it  
any SAFER*

**HIGH** up, out of the way, why bother with conduit?

But "out of sight" didn't mean "out of mind" on this job. The hazards of dust and moisture are still present, even though the wiring seems to be out of the way. So the contractor protected the wiring with full-weight, rigid-steel conduit--further simplified his work by using pre-assembled conduit racks.

In new construction, under way now and being planned, you can give owners and tenants maximum protection by specifying and installing Youngstown "Buckeye" conduit. "Buckeye" has proved its dependability in un failing, successful performance under all kinds of conditions, in all kinds of structures, for more than a quarter century.

In every respect, "Buckeye" full-weight, rigid-steel conduit meets the requirements of the National Electrical Code which says that for hazardous locations and occupancies, the only wiring system approved as moisture, vapor,

dust and explosion proof is rigid steel conduit.

Local distributors in all industrial markets have Youngstown "Buckeye" conduit in stock. For their names or for other information, write, wire or phone our nearest District Office.



Ask your distributor for:

Youngstown Buckeye Conduit...Pipe and Tubular Products...Sheets...Plates...  
Electrolytic Tin Plate...Coke Tin Plate...Bars...Rods...Wire...Tie Plates and Spikes.

## YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

GENERAL OFFICES YOUNGSTOWN 1, OHIO

Export Offices 500 Fifth Avenue, New York City

Manufacturers of

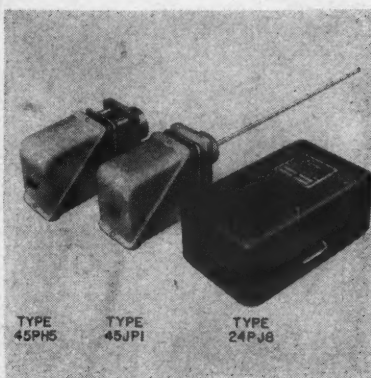
CARBON - ALLOY AND YOLOY STEELS



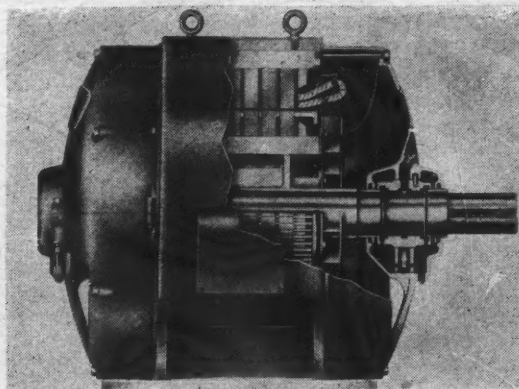


## Flame Failure Safeguard

To protect against the hazard of explosion caused by flame failure in industrial oil burner installations, a new Fireye photoelectric flame failure safeguard has been developed. It "sees" that the flame has failed and instantly turns off the fuel supply and the burner. Equipment consists of scanner type 45PH5 for monitoring the main oil burner flame and programming control type 24PJ8 for programming the oil pump, oil valve, and ignition system. Flame rod type 45JPI may be added to this combination if it is desired to monitor the gas pilot flame as well. The photoelectric system is designed to withstand conditions of relatively high ambient temperature and is impervious to ambient humidity. Relay contacts are of heavy duty type capable of handling directly a pump motor of 1 hp. rating. Combustion Control Corporation, 77 Broadway, Cambridge 42, Mass.



COMBUSTION CONTROL SAFEGUARD

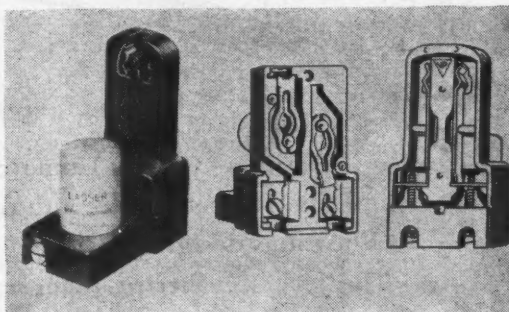


ELECTRIC MACHINERY MOTOR

with access plates designed for speedy removal and replacement. Sealed bearings can be cleaned and refilled without motor disassembly. Double end ventilation is provided by a louver on each end of the rotor. Starting characteristics are NEMA Class B for across-the-line starting. Electric Machinery Mfg. Company, Minneapolis 13, Minn.

## Lamp Socket and Starter

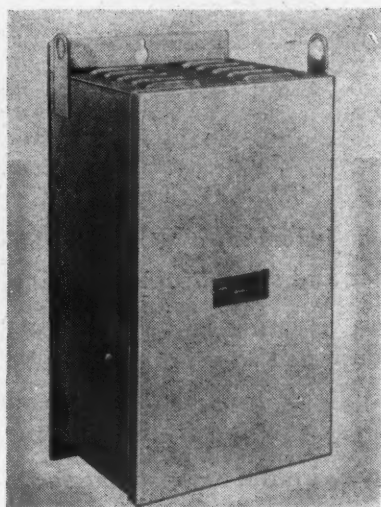
A new lock action fluorescent lamp socket and starter combination has been announced. The lamp socket has sure-grip terminals and the starter a positive, turn-lock action. Both lamp socket and starter are firmly gripped so that vibration or severe shock cannot shake them loose. The socket is designed for easy wiring into fixtures. Both socket and starter holder carry UL approval. Lasser Mfg. Co., 40 N.E. 22nd Street, Miami, Fla.



LASSER LAMP SOCKET AND STARTER

## Transformer

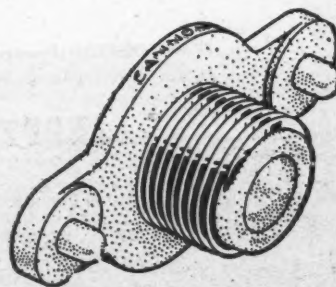
These lighting and general purpose transformers are constructed throughout with Class B, heat proof insulation such as fibre-glass, mica, asbestos, etc. This insulation eliminates the necessity of liquids and fire-proof vaults. It is claimed that mechanical improvements have resulted in reducing installation costs. The steel case which encloses a compact element also acts as a wiring compartment accessible through knock-outs. Available in sizes up to 500 kva. in voltages to 13,200 volts. Marcus Transformer Co., Inc., 32 Montgomery Street, Hillside 5, N. J.



MARCUS TRANSFORMER

## Fixture Stud

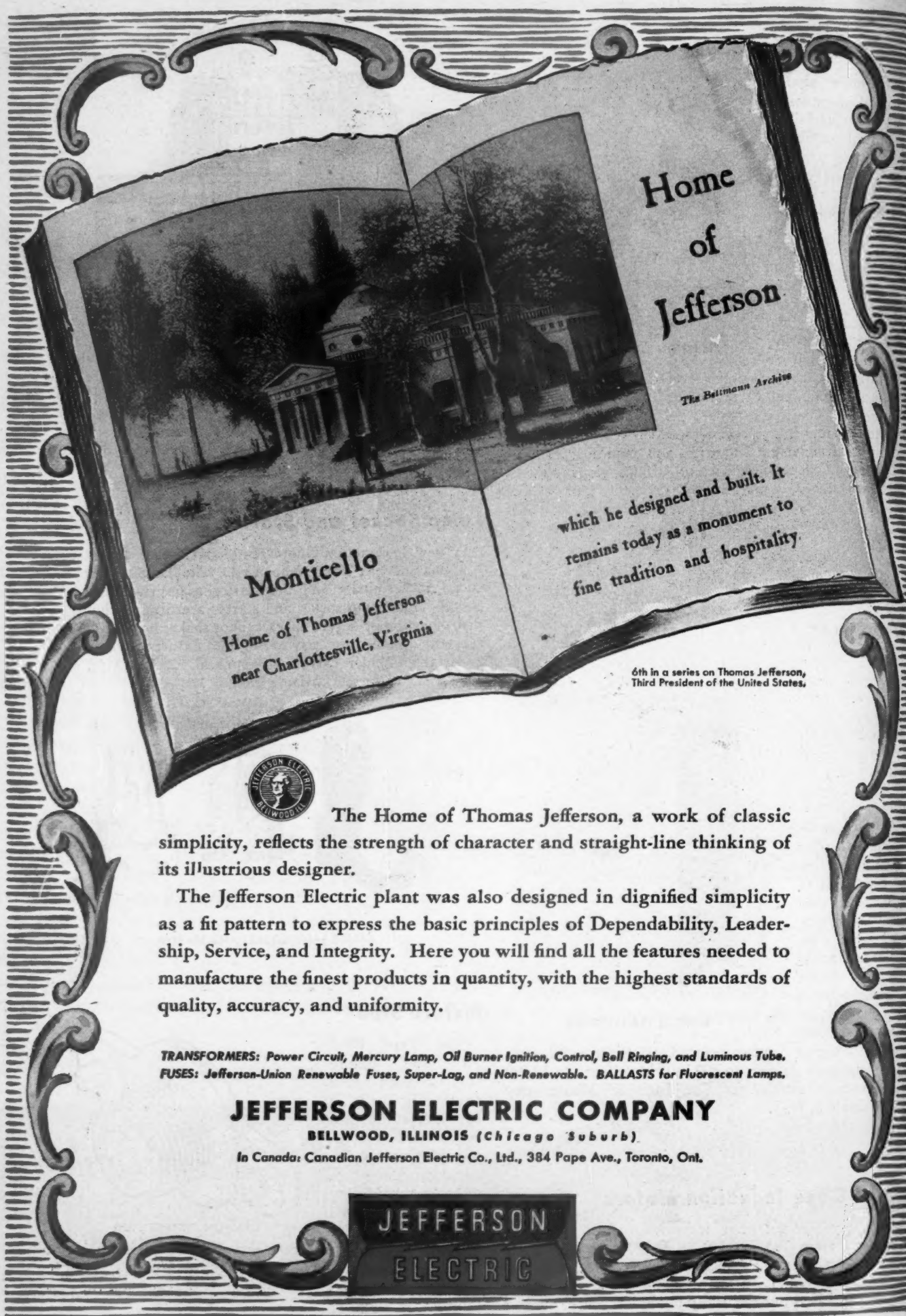
The Type FS-3 "No Bolt" fixture stud has been added to this line. It is furnished at the present time less lock-nut. Material is die-cast aluminum alloy, and the thread is  $\frac{1}{8}$  inch pipe thread type. No interior thread. The fitting has been tested to a breaking point of 600 lbs. vertically. Weight is approximately 0.193 lbs. Cannon Electric Development Co., 3209 Humboldt St., Los Angeles 31, Calif.



CANNON FIXTURE STUD

## Squirrel Cage Induction Motors

Heavy duty squirrel cage induction motors for large power drives from 100 to 1000 hp., 1800 rpm. and lower speeds are available. Fabricated steel frame shuts out falling particles, makes operation quieter, and easy to clean. Inspection and blowing out is simplified on larger ratings



The Home of Thomas Jefferson, a work of classic simplicity, reflects the strength of character and straight-line thinking of its illustrious designer.

The Jefferson Electric plant was also designed in dignified simplicity as a fit pattern to express the basic principles of Dependability, Leadership, Service, and Integrity. Here you will find all the features needed to manufacture the finest products in quantity, with the highest standards of quality, accuracy, and uniformity.

**TRANSFORMERS:** Power Circuit, Mercury Lamp, Oil Burner Ignition, Control, Bell Ringing, and Luminous Tube.  
**FUSES:** Jefferson-Union Renewable Fuses, Super-Lag, and Non-Renewable. **BALLASTS** for Fluorescent Lamps.

## JEFFERSON ELECTRIC COMPANY

BELLWOOD, ILLINOIS (Chicago Suburb)

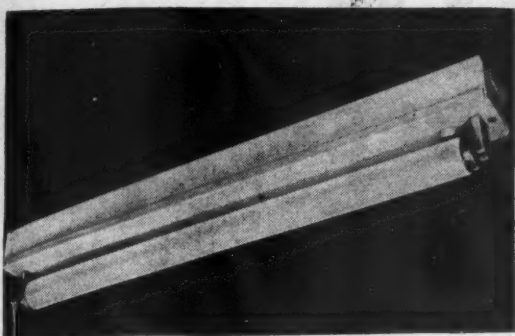
In Canada: Canadian Jefferson Electric Co., Ltd., 384 Pape Ave., Toronto, Ont.





## Fluorescent Strip Lights

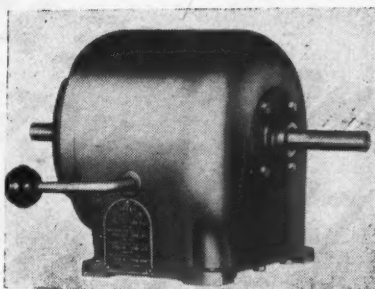
A new fluorescent channel light for commercial and industrial use and occasional lighting in home workshops, garages, etc. has been announced. The channel lights can be used individually in gang fashion or butted together for continuous strip lighting. They are readily adapted for use in offices, plants, show rooms, stores, display windows and for trough lighting where special effects are desired. Available in three models: 20 and 40 watt single lamps or 40 watt for two lamps. Electricraft Corporation, 42 Clifton Street, Newark 5, N. J.



ELECTRICRAFT CHANNEL LIGHT

## Gearshift Drive

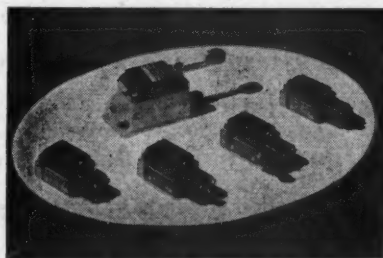
A new addition has been announced to this line of selective speed gear-shift drives. Identified as Type RD, it is designed to motorize machinery requiring selective speeds, and can be used with any standard motor of  $\frac{1}{4}$  hp. to 1 hp. rating. Gear ratios are 1 to 1, 1.33 to 1, 2 to 1 and 4 to 1. Type RD is a four speed transmission. The shift lever is available in four optional positions. Drive will operate in either direction of rotation. Comparatively small in overall dimension, the Type RD is especially adaptable to applications where mounting space is limited. The Lima Electric Motor Company, Lima, Ohio.



LIMA GEARSHIFT DRIVE

## Limit Switch

New oilproof snap action limit switches have been added to the G-E line. The switch can be used in a variety of operations through the use of interchangeable operating heads for roller - lever, roller - push - rod, push-rod, or plunger operation. It contains a single-pole, double-throw, self contained, snap action control Switchette. A molded

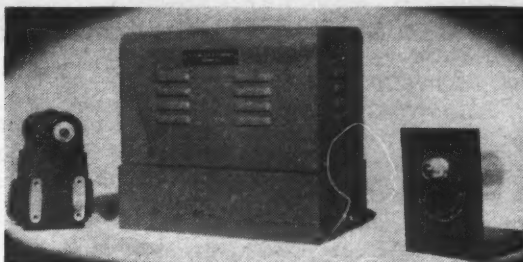


G-E LIMIT SWITCH

phenolic enclosure of oilproof construction protects it from lubricating or cutting oils and compounds. In addition to the new small switch, the standard line of track-type limit switches has been redesigned to provide such features as snap action, oilproof construction, and improved appearance. General Electric Company, Schenectady, N. Y.

## Remote Control Servomechanism

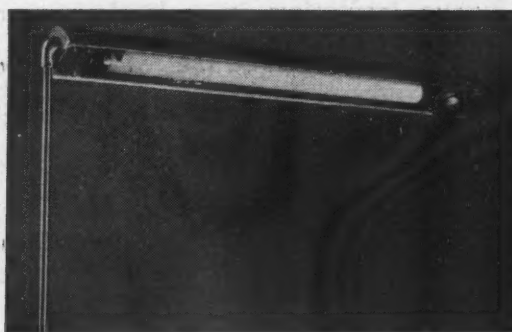
New servomechanism for remote indication or control are available. The servo consists of three units—torque, amplifier and control. The position of the shaft on the torque unit is controlled by the amplifier to correspond to the control unit. The system is sensitive to one percent changes in the control unit which requires approximately one ounce-inch of torque for operation. The torque unit develops a maximum of 50 pound feet of torque. The amplifier unit consists of three radio type vacuum tubes and associated equipment. The system operates from 115 volt 60 cycle power which is supplied at the amplifier. G. C. Wilson & Company, 2 North Passaic Avenue, Chatham, N. J.



WILSON SERVOMECHANISM

## Fluorescent Showcase Lighting

A new fixture for showcase, wallcase, and shadow box lighting has been announced. Designed for use in either modern or conventional type installations, the new fixture is a narrow, steel reflector shell that is inside-finished in polished aluminum in lengths from 2 to 13 feet for continuous lighting with up to 120 watts in fluorescent lamps. Regardless of the number of lamps used or the length of the overall installation, only two wires leave the reflector. Other features include push-in sockets, lamp ejector, brackets for mounting to wood trim or all glass cases, remote control ballast which rests under the showcase. Lustra Corporation of America, 40 West 25th Street, New York 10, N. Y.



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# Industrial Electrification

ENGINEERING • INSTALLATION • MAINTENANCE

## Overload and Short-Circuit Protection of Industrial Control Equipment

Electric power systems consist of three major elements: generating equipment, transmission and distribution equipment, and utilization equipment. Power systems must be protected against the possible damaging effects of overloads and short circuits.

When considering the complete power system, it is necessary to formulate a clear conception of the protective tasks which are to be taken care of by industrial control equipment. It has been generally accepted by manufacturers and users of electric power equipment that the protection of power generating, transmission, and distribution equipment falls in the province of switchgear. Protection of the control equipment proper, power utilization equipment, and lines between controller and utilization equipment is a function of the control apparatus.

Briefly stated, overload protection provided by control equipment considers all apparatus and connecting lines between controller line terminals and power utilization point. Motors being the most common power utilization apparatus, motor protection is the most important problem.

Types of protection to be considered in the design and selection of control equipment are:

- 1—Protection of motors against sustained overloads.
- 2—Protection of motors and driven machinery against sudden overloads.
- 3—Protection of control equipment and connecting lines below the controller load terminals against short circuits.

### General Aspects of Overload Protection

An overload on a motor can be de-

G. W. Heumann  
Control Engineering Division  
General Electric Company  
Schenectady, N. Y.

fined as an operating condition, not necessarily a short circuit, which causes a current in excess of normal current to flow in the motor power circuit. Thus, overload protection is defined as the protection of the motor, the control apparatus, and the branch circuit conductors against excessive heating due to motor overload. It can be further defined as the effect of a device, responsive to current, to cause interruption of current flow to the motor operating under an overload.

The damaging effect which an overload may have on the connected apparatus is due to the excessive temperature which the increased current flow causes the apparatus to attain. This introduces two more quantities, in addition to the magnitude of current, which must be considered in designing and applying protective devices, namely the time during which the overload exists, and the ambient temperature. In an extreme case, the temperature may rise so high as to cause melting of conductors, and thus cause permanent damage to the motor, the control apparatus, or the circuit conductors. But even if the temperature does not rise that high, any increase in temperature above rated temperature rise reduces the life of the insulation and results in shortened life of the motor.

The most commonly encountered causes of overload on a motor are as follows:

1. Sustained overload caused by

abnormal mechanical load or by low line voltage.

2. Too rapid duty cycles on intermittent drives, such as too frequent starting and stopping, which causes the rms value of current to exceed the rated motor current.

3. Excessive mechanical load, which causes the motor to stall or fail to start, thus drawing starting current for a considerable period of time.

4. Single phasing of polyphase motors, preventing the motor from starting, or causing excessive current to flow while the motor runs.

5. High ambient temperature, which causes the motor to attain higher than rated temperature even though the load current stays within the motor rating.

To afford full protection to a motor, the tripping characteristic of the overload protective device should match the motor heating characteristic. To obtain the highest degree of service from the motor, the overload relay

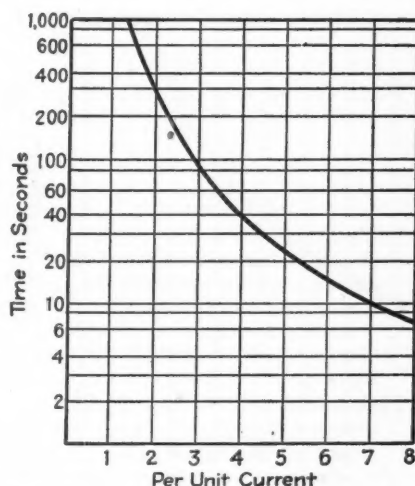


Fig. 1—Typical heating curve of an induction motor.

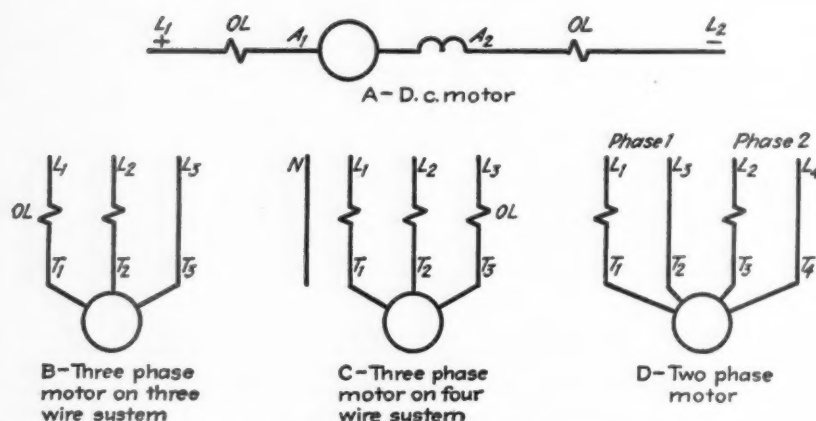


Fig. 2—Connection of overload relays in motor circuits.

should permit the motor to carry an overload for as long a time as it is necessary for the motor to reach its maximum permissible temperature, but it should disconnect the motor as soon as that temperature has been reached. Any overload protective device should thus have an inverse time tripping curve, which should follow the motor heating curve as closely as possible. Unfortunately heating curves for electrical motors are not standardized, and considerable differences may exist between motors of the same horsepower rating, but of different manufacture. A typical heating curve for an induction motor is plotted in Fig. 1. The time in seconds, necessary for the motor to reach maximum permissible temperature is plotted versus current in per unit.

Because of the variations in motor heating curves, the design of commercial overload relays must necessarily be a compromise, and the tripping characteristics of such relays must be selected so as to protect a majority of commercial motors. Unusual service conditions necessitate a

special check of motor heating versus relay tripping characteristic. Especially, if stalled motor protection is desired, great care must be exercised in selecting overload relays, since a relay which protects the motor satisfactorily at moderate overloads may be too sluggish to protect the motor under a stalled condition.

#### Overload Relays—General

Before describing the various types of overload relays available for motor protection, some points will be discussed which apply generally to all types of protective relays.

Overload relays consists of a current carrying conductor such as a coil or a heater, through which line current flows, and a contact which is actuated by the action of the current. A coil may operate the contact by magnetic force. Instantaneous and most inverse time overload relays work on this principle. A coil or a heater may cause a temperature sensitive element, such as a strip of bimetal, to heat and deflect, tripping the contact mechanically. Such relays are called thermal overload relays.

Most overload relays used for industrial control work have normally closed contacts i.e., the contacts are closed with no current flowing, and the contacts open when an overload current flows through the relay. Contactors used on magnetic controllers are generally closed by holding their coils energized. Overload protection is obtained by the overload relay contacts interrupting the line contactor coil circuits, causing the line contactors to drop out and to disconnect the motors from the line. Contrary to control practice, switchgear practice prefers mechanically latched-in circuit breakers. A trip coil, energized on overload, causes the breaker to open. Thus overload relays used on switchgear generally have normally open contacts which close and energize the trip coil upon occurrence of an overload.

Contacts of overload relays may be self-reset or hand-reset. On self-reset relays, the contact recloses automatically after the motor has been disconnected from the line. On hand-reset relays the contact stays open until it is reclosed mechanically, usually by pressing a reset button. On magnetic controllers using momentary contact pilot devices or master switches with undervoltage protection, either type can be used.

While the hand-reset feature is not necessary to obtain satisfactory operation, many control users prefer hand-reset overload relays, because the operator is forced to go to the control panel to reset the relays. This prevents the operator from restarting his drive immediately upon an overload, and there is a greater probability that the operator will investigate the cause of the overload. Hand-reset overload relays must be used on controllers with maintained contact pilot devices, as

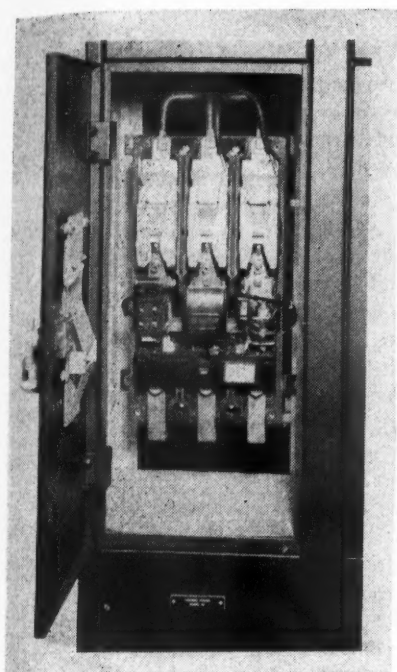
TABLE I . . . Maximum Rating of Motor Branch Circuit Protective Devices, for Motors Not Marked with a Code Letter

Type of Motor	Percent of Full Load Current Circuit Breaker Setting		
	Fuse Rating	Instantaneous Type	Time Limit Type
Single-phase, all types . . . . .	300		250
Squirrel-cage and synchronous (full voltage, resistor or reactor starting)	300		250
Squirrel-cage and synchronous (auto-transformer starting)			
Not more than 30 amperes . . . . .	250		200
More than 30 amperes . . . . .	200		200
High reactance squirrel cage			
Not more than 30 amperes . . . . .	250		250
More than 30 amperes . . . . .	200		200
Wound rotor . . . . .	150		150
Direct-Current			
Not more than 50 hp . . . . .	150	250	150
More than 50 hp . . . . .	150	175	150

TABLE II . . . Maximum Rating of Motor Branch Circuit Protective Devices for Motors Marked with a Code Letter.

Type of Motor	Per cent of Full Load Current Circuit Breaker Setting	
	Fuse Rating	Time Limit Type
All a-c single-phase and polyphase squirrel-cage and synchronous motors (full voltage, resistor or reactor starting)		
Code Letter A . . . . .	150	150
Code Letter B to E . . . . .	250	200
Code Letter F to R . . . . .	300	250
All a-c squirrel-cage and synchronous motors with auto-transformer starting		
Code Letter A . . . . .	150	150
Code Letter B to E . . . . .	200	200
Code Letter F to R . . . . .	250	200





**Fig. 3—Panelboard type air circuit breaker, 225-ampere frame, 10,000-ampere interrupting capacity, mounted in control panel compartment. (Front cover of breaker removed to show internal construction.)**

self-reset relays would cause the motor to "pump", i.e., the motor would continually attempt to restart against the overload.

The question arises, how many relays should be used and how should they be connected in the motor circuit? The connections of overload relay coils in the most commonly used motor circuits are indicated in Fig. 2. Refer to sketch A. Overload relays for d-c motors are connected in the lines to the motor armature. Relays which protect against short circuits are connected in both sides of the line. Relays which protect against operating overloads need only be connected in one side of the line, preferably the positive side, since the negative line is grounded on many industrial systems.

Three-phase induction motors are protected by overload relays in two phases, as indicated in sketch B, against both short circuit and overload. If the motor is connected to a four-wire network system, overload protective relays in two phases are sufficient, as the neutral wire has no effect on the balanced load current of the motor. However, if relays are to protect against winding faults or short circuits, any one of the three phases may short-circuit to ground, and three relays, one in each phase, are required, as shown in sketch C. Two-phase motors are protected against overload and short

circuit by two relays, one in each phase. (See sketch D.)

When selecting the size of the overload relay to protect a given motor, its service factor must be considered. Standard continuous rated motors for 40 C rise have a service factor of 15 per cent. This means the motor can deliver 15 per cent more power than its nameplate rating indicates without injurious heating, and relays should be selected for a current of 115 per cent motor full load current.

#### *Thermal Overload Relays*

This type of overload relay, which has found universal use for the protection of continuously rated motors, uses the heat storing ability of a thermal responsive element and connected mass. The heat generated by the motor load current flowing through the relay is conducted, convected, or radiated to this element. The heat transfer causes the relay contact to open when it has reached a certain temperature. By proper design of the relay parts, and by providing the necessary heat storing capacity, the heating characteristic of the relay can be made to follow closely the heating characteristic of the motor. The tripping characteristic, that is to say, the tripping time plotted versus current, should simulate the motor heating curve as shown in Fig. 1.

Classified on the basis of the temperature responsive element used, the following groups of relays are commercially available.

1. Solder pot or solder film type
2. Bimetal type

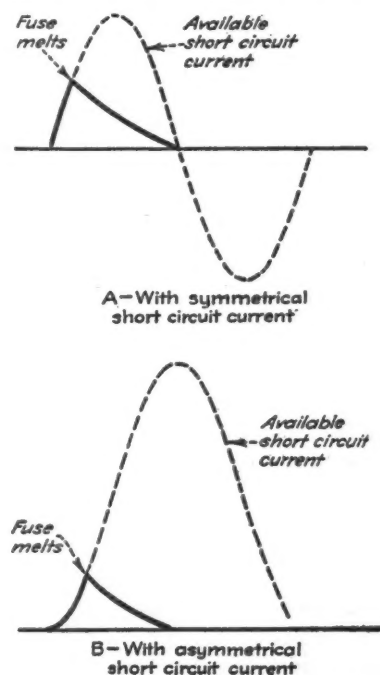
Solder pot and solder film relays utilize an alloy with a low melting point. When the relay reaches the temperature for which it is designed, the solder softens sufficiently to release a spring mechanism, which opens the relay contact. After the solder has had time to harden, the relay can be reset. Such relays are inexpensive, but great care must be exercised in their manufacture to obtain reliable operation. They are mostly used on manual and magnetic starters for small induction motors.

Bimetal relays are the most commonly used types of thermal relays. The heat responsive element is a strip of bimetal which is deflected by heat. To eliminate variations in the tripping point, the mechanical work which the bimetal strip has to perform is kept at a minimum, insuring uniform tripping. After the relay has tripped, a definite period of time must elapse before the

bimetal strip returns close enough to its original position to permit the relay to be reset.

Resistance type thermal relays contain a resistor through which load current flows. The heat generated in the resistor element is radiated, and to a limited extent conducted and convected, to the bimetal strip. A relay of this type, which is suitable for use with d-c or a-c motors, has a bimetal strip that forms a cantilever, arranged inside of the resistance element. When the strip is deflected sufficiently, a trip lever is released upward, which causes a horizontal bar to turn and to open the relay contact. By interchanging various size heaters, the relay can be used for motors of different full load currents. One, two, or three bimetallic elements can be arranged on one relay, all elements actuating the same contact. After the bimetal strips have cooled sufficiently, the reset button may be pressed, which turns the horizontal bar and pushes the trip levers downward so that they engage again with the bimetal strips.

In this case, the average time required to trip and to reset the relay in a 40 C. ambient are plotted versus per unit motor current. For currents up to 6 times normal the relay trips within a shorter time than that required by the motor to reach its ultimate temperature limit. At higher currents, the relay would not fully protect the motor. This means that, when thermal overload relays are used with



**Fig. 4—Interruption of short circuit current with current limiting fuse.**

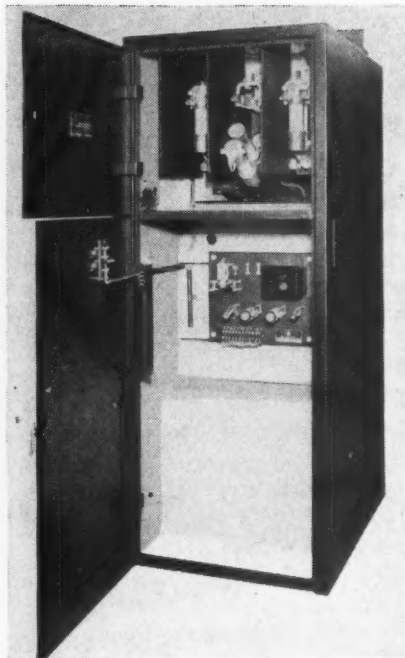
motors having a high stalled current, a careful study must be made of motor heating to determine whether the selected, relays afford motor protection during a stall.

The resistance heating elements have a limited heat storage capacity. Since there is a time lag between the heating of the resistance element and the heating of the bimetal strip, the heating element may melt and damage the relay permanently under a heavy short circuit current, before the relay is able to trip. Thermal overload relays do not afford short-circuit protection, and fuses or fast tripping circuit breakers should always be installed in the lines ahead of the relays. The National Electrical Code specifies that the rating of such fuses or circuit breakers shall not be over 4 times the rated current of the motor.

Another method to get the heat into the bimetal strip is by induction. The bimetal strip is arranged inside of a copper tube, which is surrounded by the relay coil. The coil acts as the primary, and the copper tube as the single coil secondary winding of a transformer. Load current flowing through the coil induces a current in the tube, which heats up, and the heat is transmitted to the bimetal strip in the tube. Such relays can be used only with a-c motors. Deflection of the bimetal strip actuates the relay contacts.

When applying thermal overload relays, it must be recognized that these relays are essentially responsive to temperature, and changes in ambient temperature have an effect on the current at which the relays trip. For example, the ultimate tripping point of a thermal overload relay is reached when its temperature-sensitive element is at approximately 95 C to 100 C. As long as motor and relay operate in the same ambient temperature, and the motor is applied on the basis of its 40 C ambient rating, the relay automatically compensates for variations in ambient temperature. If the relay operates in a higher ambient temperature, while the motor operates at normal ambient of 40 C, the increase in relay ambient temperature can be allowed for by selecting a larger size relay heater or coil, usually one size larger, for each 15 C increase in relay ambient temperature above 40 C.

For selecting the proper thermal overload relay heater or coil for a given motor application, the relay data published by the manufacturer



**Fig. 5—High voltage starter, rated 2300 volts, with current limiting fuse**

are used. The standard relay tables are based on general purpose 40 C rise continuous rated motors, having a 15 per cent service factor. As commercial motors are usually rated on a conservative basis, and in order to keep the number of heaters and coils of a complete line within reason, the standard relay tables are laid out so that the relay will ultimately trip at a current between 110 per cent and 130 per cent of motor full load current. This is based on peace-time practices. For motors which have been applied during the war under Conservation Order L-221 of the War Production Board, the relay table had to be modified to take into account the elimination of the service factor.

Thermal overload relays are often used with motors rated on a different basis than continuous and 40 C rise. If specific application data on the heating of such motors are not available, which would permit an accurate check of the overload relay selected, the table below will serve as a guide for selecting heaters from a standard table for 40 C rise motors as published by the relay manufacturer:

While this table may not be accurate for all motors, it works out well in the majority of cases.

Motor rating basis	Continuous capacity of motor in terms of rating
40 C rise, cont.	115%
50-55 C rise, cont.	100%
50-55 C rise, 1 hr.	80%
50-55 C rise, 30 min.	70%
50-55 C rise, 15 min.	55-60%

### Instantaneous Overload Relays

Instantaneous overload relays are electro-magnetic devices in which an armature is attracted by the flux produced by the load current flowing in the coil. The relays open their contact when the motor current exceeds a definite set value. The purpose of such relays is to protect both the motor and the driven machinery against damage due to suddenly applied high overloads. The relays offer no protection against burn-out of a motor on sustained light overloads, but they do protect against mechanical and electrical damage to the motor and the machinery if gears bind, a drive jams, or some faulty operation by the attendant throws an excessive load on the motor.

On d-c systems, which generally produce only comparatively low short-circuit currents, and on some alternating-current applications on power systems with limited short-circuit capacity, instantaneous overload relays have been used for short-circuit protection, and a contactor interrupts the short-circuit current. Such relay application can be considered only if the interrupting capacity of the contactor is adequate for the short-circuit current of the system to which it is connected. If the short-circuit capacity of the system exceeds the interrupting ability of the contactor, other means than overload relays must provide protection.

### Protection Against Short Circuits

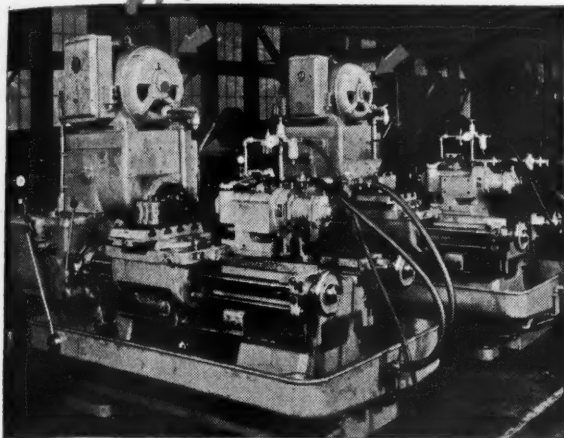
General purpose industrial control equipment is generally rated in amperes or horsepower. This means that the rating is indicative of the normal load and regular operating overloads, such as a stalled motor condition, which the control equipment is designed to handle. Control equipments may be subjected to high thermal and mechanical stresses as a result of short circuits, occurring on the load side of the control apparatus. A complete control equipment must include protection against damage of the control devices by the destructive forces of short circuit.

The magnitude of the short-circuit current which may occur at any point

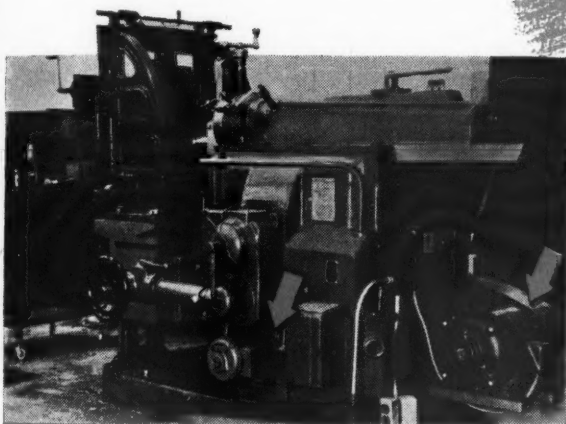
Select heater for current given in relay table, multiplied by
1.0
0.9
0.8
0.75
0.70



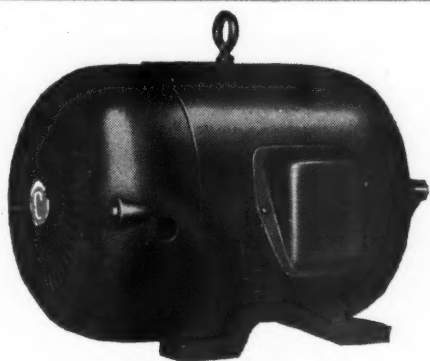
# Keep Your Machines Producing



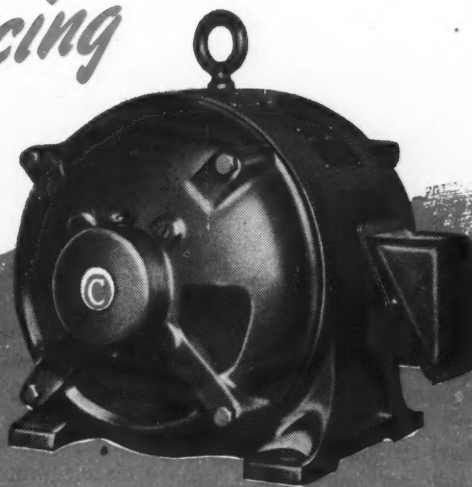
Two 30 horsepower Century motors at 3600 RPM supply the power to produce precision work at high speed.



Century motors' remarkable freedom from vibration helps to get all the precision this machine was designed to give.



Century totally enclosed fan cooled motors for installations where protection is needed against dripping water, chips, atmosphere charged with abnormal quantities of grit, metal or destructive dusts.



## with the Right CENTURY MOTOR —Correctly Protected

There is a standard Century motor to meet your requirement, whatever the load characteristics or protective housing needed.

Whether high torque, low torque, normal torque—single speed, multi speed—open rated, splash proof, totally enclosed fan cooled, explosion proof—vertical, horizontal or flange mounting—alternating or direct current, there is a Century motor correctly engineered to meet the requirements of your job.

Because Century motors are built to precision standards they will operate your equipment at top performance. Rigid construction and accurate machining plus good electrical and mechanical balance help to maintain smooth performance throughout a long motor life.

Century motors are built in a wide range of types in sizes from 1/6 to 400 horsepower to provide top performance to meet every electric power application.

### CENTURY ELECTRIC COMPANY

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in an industrial power system bears no relation to the size of the motor and the rating of the control equipment installed in any branch circuit. The short-circuit current is solely determined by the characteristics of the power system. The symmetrical short-circuit current flowing at the location of the fault is equal to the system voltage divided by the sum of the impedances between the generator and the fault. During the first half-cycle an unsymmetrical current of nearly twice the symmetrical short-circuit peak current may flow. The unsymmetrical short-circuit current peak determines the maximum mechanical stress to which controller parts may be subjected. As protective devices which interrupt the short-circuit current during the first half-cycle may prevent the short-circuit current from attaining its full value, the short-circuit current, which would flow if no protective devices were in the circuit, is called the available short-circuit current, and this forms the basis on which protective devices are selected for a given installation.

Magnetic contactors are able to interrupt ten times their normal rated current. They are also able to carry 15 times their rated current for one second. Many power supply systems exist, to which controllers are connected, which under conditions of short circuit or ground fault are able to supply currents greatly in excess of the above given values.

In order to convey an idea of the magnitude of short-circuit currents which may be encountered on an industrial power system, the following data are cited:

1. Short-circuit tests on a 600 volt d-c shop supply of a large manufacturing plant produced currents ranging from 30,000 to 60,000 amperes, depending on the location of the fault with respect to the power source. As the short-circuit current is limited solely by line resistance, it is easy to determine the short-circuit current to be expected in a given plant. On 250 volt systems the expected short-circuit current is, of course, smaller than given above.

2. Tests on low voltage a-c systems up to 550 volts with transformer sizes up to 17,000 kva obtained maximum symmetrical rms short-circuit currents of 30,000 amperes. It is likely that the short-circuit current from an average low voltage power source is between 10,000 and 20,000 amperes.

3. In high voltage a-c systems of 2300 or 4600 volts which are connected to a large utility network, short-circuit currents as high as 50,000 to 100,000 amperes may occur. In moderate size industrial plants short-circuit currents of 5000 to 20,000 amperes may be expected.

The above given figures indicate that industrial control contactors may be subjected to fault currents greatly in excess of their ability to interrupt or to carry for any length of time. Recognizing this condition, the National Electrical Code requires branch circuit protection ahead of industrial control equipment, which is intended to protect the branch circuit conductors, the control apparatus and the motor against damage by fault currents. The motor branch circuit protective devices must be able to carry the starting current of the motors, but their rating or setting must not exceed the values given in Tables I and II, unless it is impossible to start the motor with such settings. In such a case, the protective device may be selected on the basis of a higher current rating, which, however, must not exceed 400 per cent of the motor full load current.

There are two recognized devices which may be used for branch circuit protection, namely fuses and time-limit air circuit breakers. The maximum permissible ratings which are prescribed by the National Electrical Code are given in Table I for various types of motors, not marked with a code letter. Recently, code letters have been introduced for all single-phase and polyphase squirrel cage motors and synchronous motors rated  $\frac{1}{2}$  hp. and larger. The code letter designates the locked rotor starting kva. per horsepower as follows:

Code Letter	Kva. Per Hp. Locked Rotor
A	0.0—3.14
B	3.15—3.54
C	3.55—3.99
D	4.00—4.49
E	4.50—4.99
F	5.00—5.59
G	5.60—6.29
H	6.30—7.09

Code Letter	Kva. Per Hp. Locked Rotor
J	7.10—7.99
K	8.00—8.99
L	9.00—9.99
M	10.00—11.19
N	11.20—12.49
P	12.50—13.99
R	14.00—and above

Table II lists the maximum per-

missible rating of motor branch circuit protective devices, as established by the National Electrical Code for motors that are marked with a code letter.

When selecting either a fuse or a circuit breaker for protecting an industrial controller, consideration must be given to the time that is required for the protective device to operate after the fault has occurred. During that interval of time the controller is subjected to stresses due to the fault current. The less energy is permitted to flow through the controller during the fault, the less probable is occurrence of damage due to fault current.

Small contactors, NEMA size 3 and smaller, have limited thermal capacity. To prevent overheating of current carrying parts, the protective device should interrupt the fault current in less time than one half cycle. Tests have shown that NEC (National Electrical Code) non-renewable cartridge fuses, when selected in accordance with Table I, provide adequate protection. In establishing the fuse rating for a given motor, the following factors have to be considered. If the fuse is too small, it overprotects the motor and blows on overloads which should be taken care of by the overload relay. If the fuse is too large, too long a time is required to interrupt the fault current and overheating of the controller may result during the duration of the fault. This is the reason why under no circumstances should the fuse rating exceed 400 per cent of motor full load current.

Larger contactors, NEMA size 4 and larger, have greater thermal capacity and are able to withstand the effects of fault currents for several half cycles. Air circuit breakers, such as shown in Fig. 3 are used with such contactors. Such breakers have an inverse time tripping characteristic for moderate overcurrents, preventing the breaker from tripping on motor starting inrush current. Under high short-circuit currents, these breakers open instantaneously, and an adequate air circuit breaker interrupts a short-circuit current, equal to its interrupting rating, in four half cycles or less. Instantaneous trip breakers are often used on d-c circuits, but not on a-c circuits.

#### High Voltage Current Limiting Fuses

Many installations of industrial control equipment are in use today on 2300 and 4600 volt systems, the only short-circuit protection of which consists of oil circuit breakers in the sub-



# Cooler Operation of Switches and Panels with Fusetrons Reduces Needless Blowing of Fuses

Switches and panelboards stay cooler with Fusetrons—because Fusetrons have very much less resistance than ordinary fuses. Since heat produced by the flow of current is proportional to resistance—Fusetrons generate very much less heat than ordinary fuses.

This cooler operation means the elimination of needless blows and useless shutdowns that are the result of heating in fuses.

Cooler operation also adds to the life of switches and panelboards.

## LOOK at the Resistance of Fusetrons compared to the Lowest Resistance Fuse

Chart shows resistance at full load in ohms.

Notice that fuses have 55 to 140% greater resistance than Fusetrons. That is why Fusetrons reduce heating—keep circuits in operation—prevent costly shutdowns.

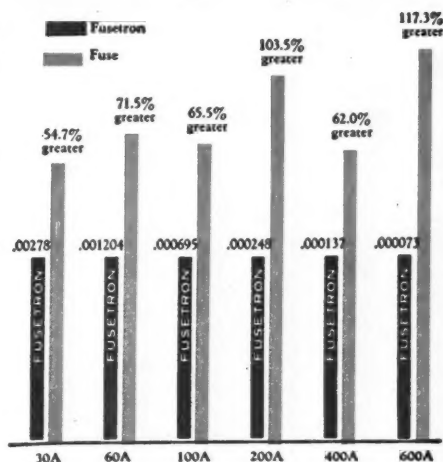


Chart shows 250 volt sizes. 600 volt sizes show similar results.

## Fusetrons Give Many Other Kinds of Protection Heretofore Not Available



### What Is the Fusetron?

The Fusetron is a dual element device—a fuse to which is added a thermal cutout.

The result is a fuse with tremendous time-lag and much less electrical resistance.

Fusetrons have the same degree of Underwriters' Laboratory approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses, Fusetrons fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere in both 250 and 600 volt types. Also in tamper-resisting type (Fustats) for 125 volt circuits.

Their cost is surprisingly low.

Fusetrons do everything fuses do, as is confirmed by the Underwriters' Laboratories' Label, and in addition

- ★ Provide simplest way to stop burnouts from single phasing.
- ★ Entirely wipe out needless blows caused by motor starting currents or other harmless overloads.
- ★ Give thermal protection to panel boards and switches.
- ★ Prevent needless blows caused by heating in panels and switches.
- ★ Protect motors against burnout.
- ★ Give double burnout protection to large motors.
- ★ Make burnout protection of small motors simple and inexpensive.
- ★ Permit use of larger motor or adding more motors on circuit without installing larger switch or panel.
- ★ On new installations, proper size switches and panels can be used instead of oversize.
- ★ Protect coils, transformers and solenoids against burnout.

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One needless shutdown—one destroyed switch or panel—one burned out motor may cost you far more than replacing every fuse with a FUSETRON.

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Please send me complete facts about BUSS Fusetrons.

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Title \_\_\_\_\_

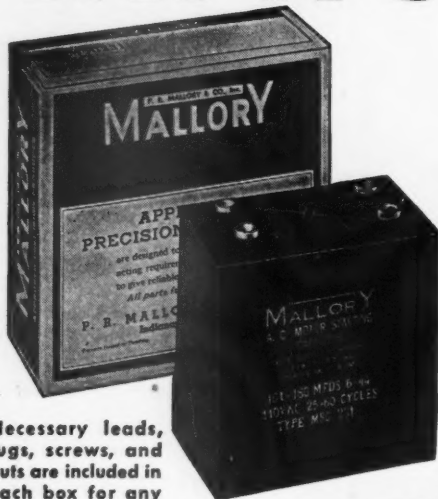
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# FUSETRONS

# DEPEND ON—INSIST ON— P. R. MALLORY & CO., Inc. MALLORY CAPACITORS



Necessary leads, lugs, screws, and nuts are included in each box for any type connectors.

**Mallory MSG Capacitor:**—Small, compact AC Motor Starting Capacitor that fits almost every mounting bracket or box. Replaces rectangular capacitors with leads, lugs or studs. Each capacitor is packed with complete set of universal mounting hardware and installation instructions.

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station. Such protection used to be considered adequate as long as industrial power systems were small, and the short-circuit currents under the worst condition amounted only to a few thousand amperes. With the growth of power systems in industrial plants, especially when connected to large public utility networks, available short-circuit currents have risen to many thousand amperes. This is greatly in excess of the interrupting capacity and the short time current carrying ability of control apparatus. Circuit breakers and high voltage fuses, which require several half cycles to interrupt the fault current, permit the short circuit current to flow too long through the controller, and severe damage has occurred to control devices under fault conditions.

Current limiting fuses, which were introduced in the United States in the late 1930's, afford excellent protection to industrial control equipment. A current limiting fuse is a fast acting fuse, consisting, for instance, of a silver wire embedded in quartz sand, which interrupts the short-circuit current during its initial rise in the first half-cycle. Thus, the current is interrupted before it has reached the first peak of the available short-circuit current. In Fig. 4 the current limiting action is illustrated. The dashed curves are the available short-circuit current, drawn both for the symmetrical and the asymmetrical case. The solid curves are the currents actually flowing in the controller. Because of the steeper initial rise of current, the fuse interrupts at a higher current when the short-circuit current is symmetrical. Fuses are rated on the basis of their ability to interrupt the available short-circuit current of the circuit on which they are installed.

When applying current limiting high voltage fuses, the same factors have to be considered as in the application of low voltage fuses. The fuse should have a sufficiently high current rating so that it will not interrupt on starting and operating overloads. It should not be too large to interrupt the short-circuit current for which the fuse is selected, during the initial current rise in the first half cycle.

In appearance, current limiting fuses do not differ greatly from conventional fuses. In Fig. 5 a set of three fuses is shown installed in the top compartment of a 2300-volt starter. The fuse fittings are so arranged that the fuses can be used as switch-hook operated disconnect switches, eliminating separate disconnect switches.

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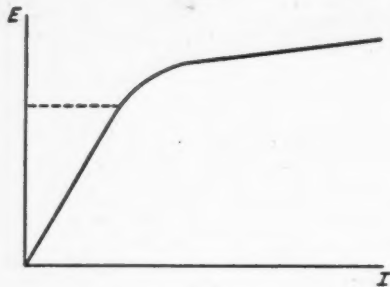
# Reader's Quiz

## Determining Voltage and Hp. of Motor

**QUESTION 241**—I would like to know how to find the voltage and horsepower rating of a three phase squirrel cage motor without a nameplate.—J.P.G.

**A.** TO QUESTION 241—The active material of an electric motor is the iron and the copper. A motor operates at rated voltage when the iron is fully magnetized. It operates at rated horsepower when the conductors are fully loaded.

To determine rated voltage, connect the motor, at no load, to a variable voltage. Plotting the voltage "E" versus the no-load current "I" gives, in a first approximation, the magnetizing curve. As long as voltage and current are proportional, the iron is not saturated. Saturation



takes place when the "knee" is reached, that is, when an increase in voltage draws a more than proportional increase in current. While the knee is not sharp, this procedure should be sufficiently accurate to find the nearest standard voltage.

To determine rated load current, connect the motor to a known load such as a Prony brake, or a generator which in turn operates on load resistors. Rated load is achieved when the temperature rise reaches the permissible limit. Horsepower output, in case of a Prony brake, is the measured torque x motor rpm. x a constant. In case of generator load, it is equal to the generator output, plus its losses.

The tests described above can be made by the Electrical Engineering Department of a college or trade school, an independent testing laboratory, such as ETL, or on a manufacturer's test stand.—L.F.R.

**A.** TO QUESTION 241—The ratio of the total magnetizing current to the wattless current necessary to magnetize the air gap alone may be used to determine the proper terminal voltage for the squirrel cage induction motor. A tangent from the origin to the running excitation curve intercepts the portion of the magnetizing current for the air gap resulting from the corresponding terminal voltage. A running excitation curve may be plotted by raising the applied voltage on the unloaded motor in steps from the voltage necessary to turn the rotor over and noting the corresponding excitation currents until unusual operating conditions begin to be observed. Ordinates drawn at the standard values of voltage will intersect the two curves and give various ratios of total magnetizing current to air gap magnetizing current. The ratio nearest to 1.4 will determine the rated voltage sought by these tests.

The horsepower rating of the motor may be determined by running it at different loads. The loading which results in a temperature rise of 40 degrees Centigrade during four hours of continuous operation will determine its horsepower rating.

In using a 60 cycle supply for this test, it is necessary to be careful not to connect a 25 cycle, 2-pole, 1500 rpm. synchronous speed wound rotor motor to the 60 cycle supply, risking damage to the rotor windings at the excessive speed of about 3600 rpm. A large motor of relatively few poles would probably be of the 25 cycle type. A motor whose excitation ratio at the standard voltages is not approximately 1.4, may also be a 25 cycle motor. This ratio of a 25 cycle motor tested on a 60 cycle supply should occur at a voltage of about 60/25 of the rated 25 cycle voltage.—R.G.C.

## Eliminating Static

**QUESTION 242**—We are having considerable trouble with our cellophane paper curling due to static current. I would like to know if it would be possible to build a static eliminator and how?—R.E.P.

**A.** TO QUESTION 242—Static problems are often baffling. Specific solutions seem simple enough after they are discovered through trial and error. What may work under one set of conditions is not always the answer for another.

What might be the cause of the static problem? Is the cellophane being used near static producing belts and equipment? Does the charge come from movement of the cellophane with respect to air currents? Does one employee have less trouble than any other? If so, how does his clothing, or handling the material, differ from the others? Is the condition more noticeable under certain atmospheric conditions?

If the conditions can be controlled, some experiments may be made by varying the humidity of the work room. Another attack may be placing a fan so that it will blow directly on the cellophane. The other extreme would be to set up baffles to prevent any air movement on the material. The cellophane might be caused to touch a grounded bar or plate just before it is used. Hanging grounded Christmas-tree tinsel where the material would have to strike it might solve the problem.

If other considerations would allow, passing the cellophane through a water spray or bath, just before the point of use, is a suggestion. Causing the employees to make skin contact with a grounded bar or plate also may end the trouble.

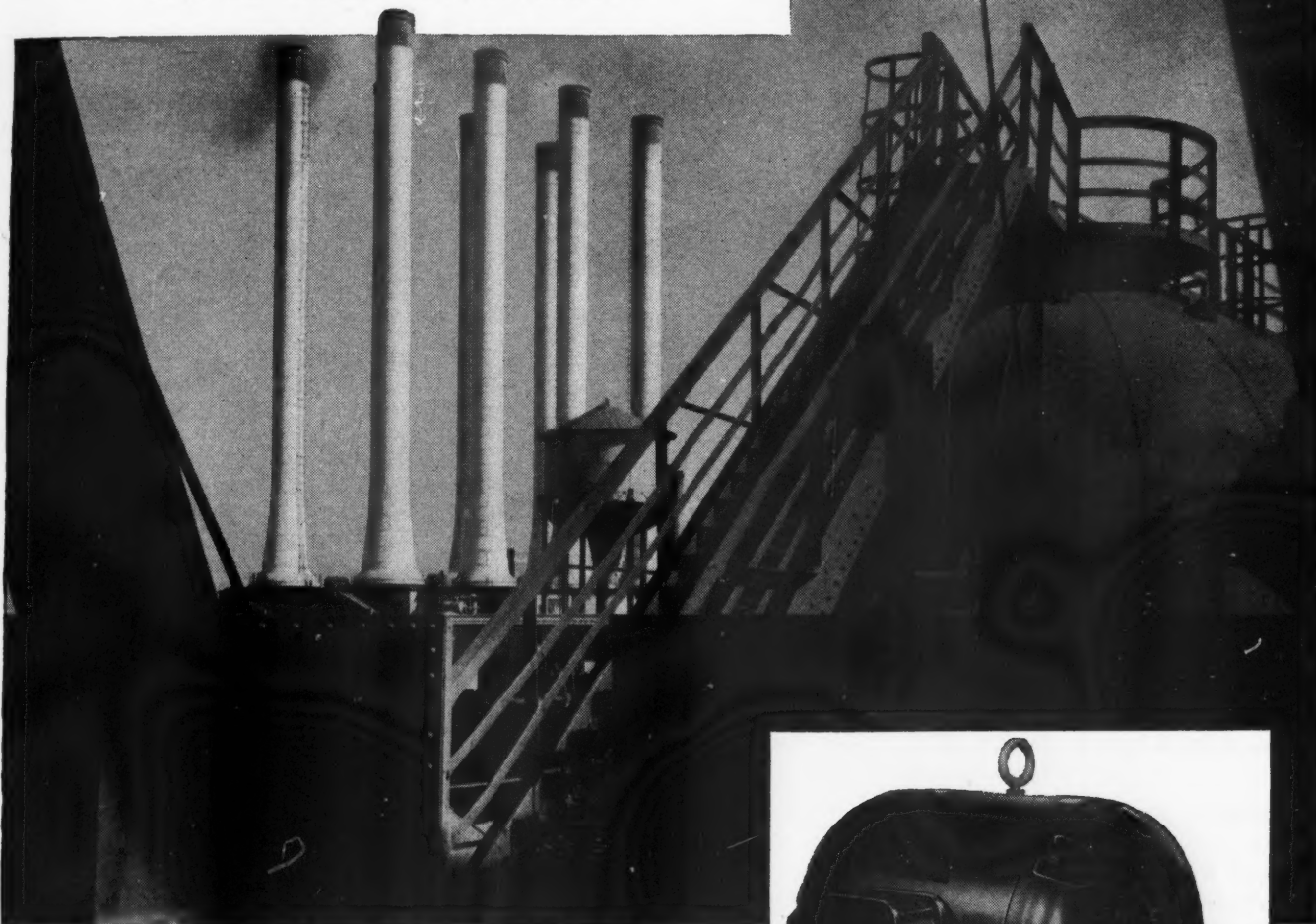
Printers have had trouble from static causing papers to stick together. Some have been able to solve their problems by various means. It would not be amiss to talk to several in the neighborhood.

Before going to too much trouble, it



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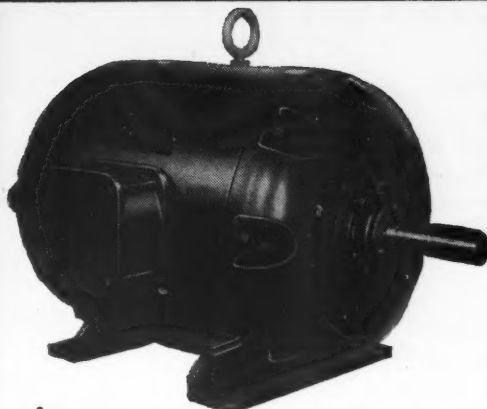


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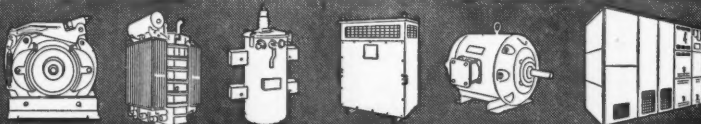
Twenty-nine branch offices, located in principal cities, are at your service to help you in your safety program. A call will bring a trained field engineer, or bulletins on the complete line of Wagner Quality Motors will be sent upon request. Address Wagner Electric Corporation, 6413 Plymouth Avenue, St. Louis 14, Mo.



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should be fully determined how much of the difficulty is caused by any natural curl in the cellophane itself.—L.E.B.

**A.** TO QUESTION 242—Static electricity which can be produced experimentally by rubbing a glass rod with a silk handkerchief is strictly speaking "frictional" electricity. When two non-conducting solids or two liquids are brought into intimate contact and then suddenly separated, a static charge is built up if other conditions are favorable. One body assumes a positive charge and the other a negative charge. Industrially static electricity is desirable for instance when it is used to de-tear painted surfaces, to precipitate imperceptible air borne solids in an air conditioning system, or to deposit printer's ink on paper without "make ready". But generally it is considered undesirable in industry and in fact a real danger with treacherous possibilities.

The various remedies for static electricity problems aim to prevent the static voltage from building up to the point of undesirable attractive force or to sparking voltage. The first method is to create a humid atmosphere of at least 75% and this should cause the static electricity to disappear. A more positive method is to cause the electric charges to be led harmlessly to ground by letting light strips of grounded Christmas tree tinsel dangle 1/16" above but not touching the cellophane at periodic intervals along its length of travel. A third method is to neutralize the charge by any of several procedures:

1) The use of a continuous source of radio-active alpha radiation. One device is made up of a radium salt uniformly distributed on a thin gold foil and welded to a heavy steel shield. This device should be located about three inches away from the cellophane.

2) The printing press industry sometimes uses a row of small gas jets burning close to the paper, but the paper travels at such a high rate that it is not ignited.

3) Electric neutralizers use a high voltage ignition type transformer to charge a row of steel teeth. The voltage is made high enough to cause ionization. The charged ions that are opposite in polarity to the static charge on the cellophane are attracted to the steel teeth and are neutralized.—M.D.P.

**A.** TO QUESTION 242—The methods employed by paper manufacturers to eliminate static are commonly known and R.E.P. does not state whether or not he has tried any of them.

I have had trouble with static on



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250 VOLTS  
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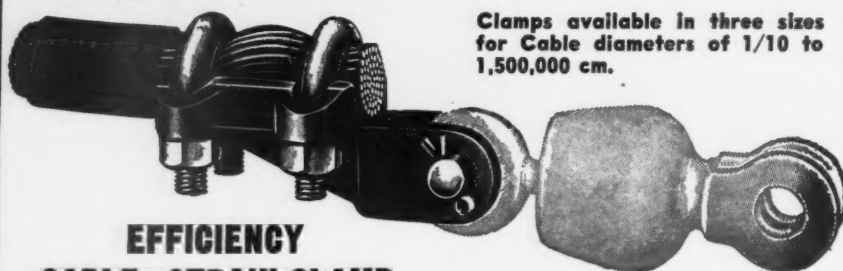
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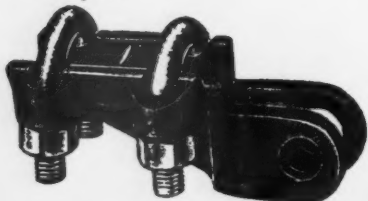
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very light cotton products being processed, and could not remove it with static eliminators. However, I did overcome this difficulty by controlling the humidity of the atmosphere, in some cases passing the product over a dampened sponge.

Static will not accumulate under damp humid conditions.

I would suggest R.E.P. try this if the known methods of static elimination fail.—J.H.P.

**A.** TO QUESTION 242—Static, causing trouble with your cellophane, can be dissipated by raising the relative humidity of your room air to 60% or more. Equipment for doing so is on the market. A simple one we use is a steam jet exhausting into the air, supplied by a 5 pound line and controlled by a solenoid valve. This valve is in turn controlled by a mercury switch which is actuated by a hair hygrometer, the adjustment scale being calibrated in per cent relative humidity.—J.B.C.

## Can you ANSWER these QUESTIONS?

**QUESTION E11**—I live in a 25 cycle district and occasionally get 60 cycle, R. I. motors for repair. Some of these repulsion induction motors have two brushes 90° apart and some have four brushes. Please explain if some of these have cross connectors or different type windings and why. Also, what are the advantages and disadvantages of these different arrangements?—J.H.G.

**QUESTION F11**—We have power transformers connected in open delta, with the power company's meters on the primary side. Transformers in open delta operate at only 86.6—power factor. Does this mean we are losing 13.4% of the power paid for?—H.C.L.

**QUESTION G11**—We are rebuilding our feeder system (3 phase, 220 v.) and installing a system of bus duct of 2000 amp capacity. We are not able to obtain copper bus for the bus in the switch cabinet, but we can obtain aluminum bus.

We are not sure if the connection of copper bus to aluminum bus would be practical, or permissible. If practical, what type of connection should be used?—D.R.M.

PLEASE SEND IN  
YOUR ANSWERS BY MAY 15



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# Questions on the Code

## Receptacle Rating

**Q.** Regarding Rule 2123 (b) it states that receptacles of not over 15 amp. rating can be used on 15 amp. branch circuits. Why is this?

I should think it would be opposite, as, for instance, "Receptacles of not less than 15 amp. rating can be used on 15 amp. branch circuits."

In other words, wouldn't it be better to use receptacles of a higher rating, in case they use larger appliances?—A.M.

**A.** It would seem better generally to place a minimum limit on the size of a receptacle rather than a maximum size, but inasmuch as the rating of any one portable appliance which can be used on a 15 ampere branch circuit is 12 amp., the use of larger receptacles would only tend to encourage the use of appliances which would violate this restriction (see the first complete sentence of 2126a.—F.N.M.S.

## Conductors

**Q.** We find it difficult to obtain 8-ft. clearance of conductors passing over the roofs of some farm buildings due to the practice of using 35-foot poles for the yard poles. Is it really necessary to maintain this clearance even though the spans may be relatively short so there is no possibility of the wire sagging sufficiently to contact the roof?—D.C.

**A.** The 1947 edition of the National Electrical Code has reduced the former 8-foot clearance requirement to 3 feet when the voltage between conductors is not more than 300 and the roof cannot readily be walked upon. The 8-foot clearance is still required whenever conductors pass over flat roofs, or sloping roofs which may easily be walked upon. This change in clearance requirements will be found under Section 2322a.—G.R.

## Explosion-Proof Equipment

**Q.** We have been given a job of wiring a new soybean oil extracting plant using the process known as the extraction process. The beans are ground and placed in the extraction tanks within the same building. Shall we wire this building with explosion-proof or dust-tight equipment?—C.H.

**A.** An oil extraction plant such as you mention usually uses hexane as a solvent. Hexane is somewhat similar to gasoline from a hazard point of view so any room in which hexane vapors are likely to be found should be considered as a Class 1 Group D location. There are some explosion-proof devices suitable for use in both Class 1 and Class 2 locations, but it is still impossible to obtain all types of wiring devices and electrical appliances which might be safe if used where subject to both dust and vapor hazards. It would seem that the design of the plant should be such that the grinding and cleaning operations should be separated from the extraction process by a fire wall or at least a dust-tight wall.—G.R.

## A Wiring Problem

**Q.** We are wiring a store building constructed with concrete block walls. Will the code allow us to fish romex through the hollow spaces in these walls?—F.F.

**A.** This is a question that cannot be answered as each individual installation must be investigated before a decision can be made as far as the exterior walls are concerned. Section 3362 of the Code states that cable may be fished in the voids of concrete blocks or tile if the cable will not be subject to excessive moisture or dampness.

Concrete block walls are not uniform in their resistance to moisture penetration nor are the individual blocks alike in the pattern of the air voids used. A wall constructed only of blocks without moisture seals may be very wet due to moisture penetration from driving rain or from condensation of moisture from humid atmosphere within the building. Therefore in each case individual consideration must be given to exterior walls before using the voids within the blocks or tiles for wireways.—G.R.

## Smaller Sized Wire For Switch-Loops

**Q.** Several times lately, I have found No. 14 used on switch loops to individual fixtures. I have always used the same size wire throughout an installation, except for loads that require more, and have always considered it poor practice to use No. 14 switch loops on a No. 12 wire branch circuit, but is the practice being permitted? Does 2106 mean that No. 14 should be run to a switch and back, regardless of the distance, while the circuit is wired with No. 12?—W.P.

**A.** No. It would be poor practice to use No. 14 wire switch loops on a No. 12 wire 20 amp. branch circuit. Such a rule was proposed but was turned down at the last meeting of the Electrical Committee and therefore is not permitted in the 1947 Code and was not permitted by previous codes.

The Code does permit however, (but does not require) that taps to individual lampholders or to individual fixtures or to individual outlets where not over 18 inches long, may be smaller than the branch circuit wire provided it has the proper carrying capacity for the load served.

There is however, one possibility under which No. 14 wire switch loops could be used on a branch circuit using No. 12 wire which would not violate



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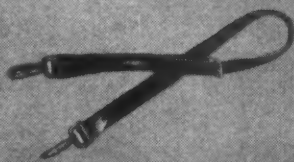
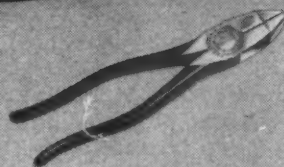
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the tap rule (2121-c-2) of the 1947 Code but could be construed as a violation of the 1940 tap rule (2106). A 15 amp. branch circuit may be wired with No. 12 wire (or even larger for that matter) but the determining factor is the rating of the over-current device protecting the circuit—in this case a 15 amp. fuse or circuit breaker. On such a circuit which may, of course, be wired with No. 14 wires, the switch loop (or any other part of the circuit) may be of No. 14 wire even though the main part of the circuit is No. 12 wire.

The poor part of such an arrangement is that someone noticing the No. 12 wire may mistake it for a 20 amp. branch circuit and use it at 20 amps. which then might create a violation. —F.N.M.S.

## Filling Station Wiring

**Q.** We have received a red tag on a new filling station job with the notation that circuits supplying the pumps must be controlled by two pole switches. Is this some local idea or is it part of the national code? —M.S.

**A.** Section 5142 of the Code states that all circuits supplying dispensing pumps shall be controlled by a switch having a disconnecting pole in each conductor. The reason for this rule is to assure there being no current on the neutral should it be necessary to service this equipment after its original installation. Otherwise, even though the circuit switch was open, it might be possible to obtain a spark during servicing operations which could ignite gasoline vapors. —G.R.

## Elbows

**Q.** Will you please advise where in the 1940 Code, permission is given to use the small radius explosion-proof and dust tight elbows?

The only reference I find in regard to rigid conduit elbows is in Section 3470. —C.L.M.

**A.** There is nothing in the Code relative to the minimum radius to factory made bends or elbows must or may be made.

The Code does, in Section 3470, limit the radius of field made bends to not less than six times the actual internal diameter of the conduit. (A table showing the minimum radii for



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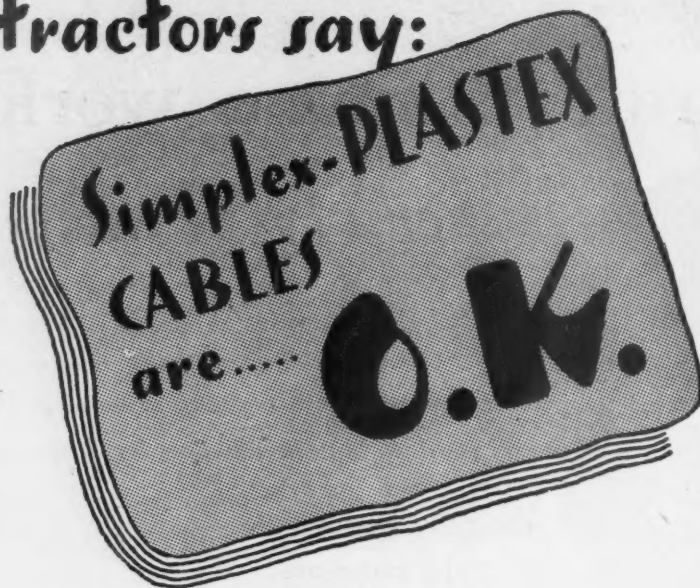


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the various size conduits will be found in Section 3470 of the 1947 Code.)

Factory made bends and elbows are made according to Underwriters' Laboratories' Standards which standards have been promulgated after many years of testing under field conditions and studying the ease of pulling wires through them. These factory made bends are always in the shape of a smooth curve with no kink of any sort in them to lessen the cross-sectional area. Field made bends are not always quite so good.

Underwriters Laboratories now are also listing under "Conduit Fittings," "Short Radius Elbows" but stipulate that they are "for use at outlets only." This latter stipulation takes into consideration the fact that the wires can be eased around these short-radius bends at the outlets but could not be eased around them if they were inserted in the conduit runs.

The Laboratories also list under "Equipment for use in Hazardous Locations:" — "Conduit Fittings," "Short Radius Capped Elbows," and a state that these "are intended for use where it is desirable to have a 90 degree bend and where wires may be guided when being pulled through conduit line." Of course with the cap off, the wires may be easily guided around the bend.—F.N.M.S.

### Wiring A Creamery

**Q.** Will the new code require that a creamery or cheese factory be wired in conduit?—M.L.

**A.** No, the 1947 Code will permit the use of electrical metallic tubing when made up with water-tight fittings or even the use of rubber sheathed cable wiring with water-tight boxes. If either conduit or tubing is used, it must be supported at least one-half inch from the wall or ceiling surface in all rooms where walls are frequently washed. This is a new code provision, and it will be found under Sections 3464 and 3484.—G.R.

### Farm Wiring

**Q.** We have wired a number of farms on R.E.A. and we have always removed the mop boards and either drilled the studs or notched them. Lately we have found most of the farm dwellings insulated and are forced to use notches almost exclusively and the new inspector refuses to accept a notched job unless we



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need of rewiring or adding new fixed outlets. Maintenance costs are minimized, because all current-carrying bus bars are firmly supported in the duct casing and long extension cords are unnecessary.

Your plant can have all the advantages of this modern electrical distribution system if you consult a BullDog Field Engineer right away. He'll give you full technical information and show you a BullDog installation near your own plant. Or, if you'd like descriptive literature, write BullDog direct.

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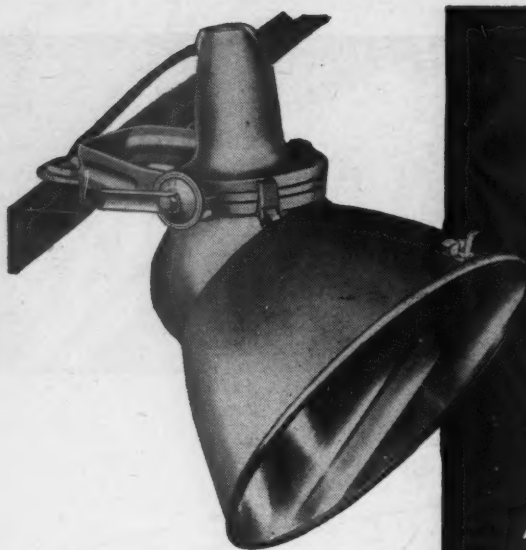
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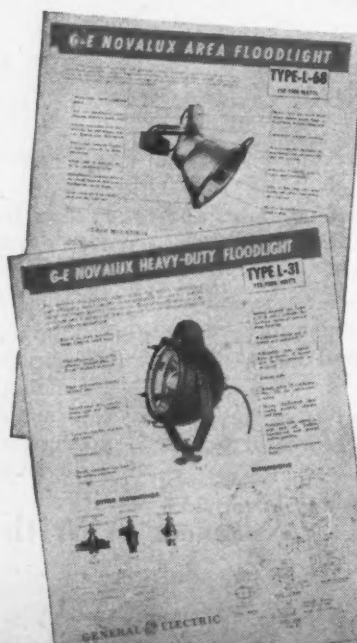
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200 or 250 watts, Type L-38	GEA-4325
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750 or 1000 watts, Type L-43	GEA-4310
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**GENERAL  ELECTRIC**

fasten a heavy metal plate over the cable on each stud. Does the Code specify the thickness of this metal plate?—F.I.R.

**A.** The old 1940 Code stated that a suitable metal plate must be placed over the nonmetallic sheathed cable placed in a notch in the studs or joists. The new 1947 edition, however, under Section 3010 states that this metal plate shall be steel at least  $\frac{1}{8}$  inch in thickness.—G.R.

## Cable in Concrete Blocks

**Q.** Please advise if it is permissible to fish lead covered cable in the hollow spaces of concrete block walls.—C.G.E.

**A.** Lead armored cable Type ACL (in the vernacular of the trade BXL) could be used in the hollow spaces of concrete block outside walls but *not* plain lead covered single or twin wires (Type RCL or RDL). For inside walls the lead in the cables would not be needed.—F.N.M.S.

## High Voltage Wiring

**Q.** We plan to wire a four story building which will use a large amount of current. We would like, if possible, to bring in the service from an underground network at 13,800 volts with two transformer rooms, one on second floor and one on fourth floor. The building will be of fireproof construction. Service disconnect will be located in the basement adjacent to the point of entrance of the service and will be housed in a separate fireproof room. May the conduit runs between this switch room and the two transformer rooms be run in the open or must it be enclosed within a masonry duct?—C.Q.

**A.** The 1947 Code will permit the conduits to be run in the open. Section 7112 states that all circuits of more than 15,000 volts between conductors shall be installed only in transformer vaults, etc. or enclosed in fire-resistive material not less than two inches in thickness. The 1940 Code required the special precaution for voltages in excess of 7,500 volts. It will be an excellent idea to carefully identify any conduit containing such circuits. This last precaution is not a Code requirement, however.—G.R.



# Motor Shops

## Quick-Set Head For Winding Coils

Something new has been added to the mass production techniques employed at Tennessee Electric Motor Service, Nashville small motor repair specialists.

Dissatisfied with available equipment, M. E. Assalone, clever employee of this firm, designed and built an adjustable winding head that puts a noticeable crimp in rewinding time. The device has reduced set-up time to less than 60 seconds; can be used for making coils for any standard single-phase motor up to 5 hp. and for most special motors from  $\frac{1}{8}$  hp. up. Mr. Assalone has a patent pending on the design, details of which were released for publication by the Committee of Awards, National Industrial Service Association.

Salient feature of the device is the quick-set adjustment for making various sized coils. A twist of the adjusting screw and tightening of a set screw suffices to adjust any segment of the head. No disassembly, reassembly or clamping is necessary.

Like most conventional concentric heads, this unit (Fig. 1) has two halves

mounted to a holding bar which attaches to the winding machine shaft. Graduations on the bar facilitate setting each section equidistant from the center (based on slot length).

Greatest time saver, however, is the automatic adjustment of step cones for coil span. Each half section contains ten segments providing the various steps. Each segment, divided in half, is fastened to a center bar by a double-threaded adjusting screw and guide rod (Fig. 1 and 2). Turning this screw, which is anchored to the center bar and has right hand thread on one end and a left hand one on the other, moves each half of the segment an equal distance from the center bar. Once adjusted for proper coil span, the segment is locked in place by a set screw. Graduations on the flat surface of each segment facilitate proper settings. Mounting of half sections to the holding bar is such that the section can be turned 90 degrees to facilitate transverse adjustment of individual steps (Fig. 3).

To further speed rewinding time, Mr. Assalone has developed a chart

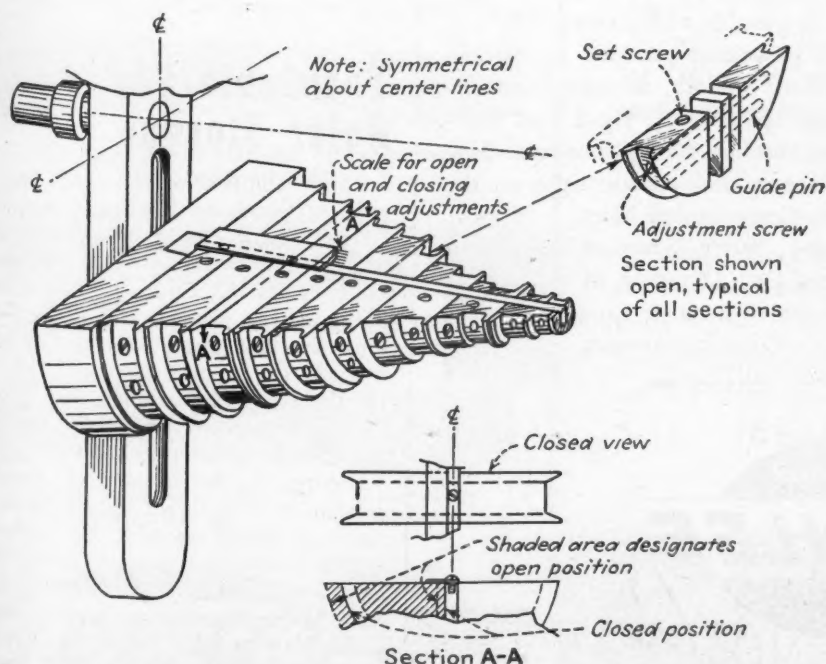


FIG. 1—Design details of Mr. Assalone's quick-set concentric coil winding head (Patent Pending). Note feature of adjustment and set screws for transverse setting of step segments.

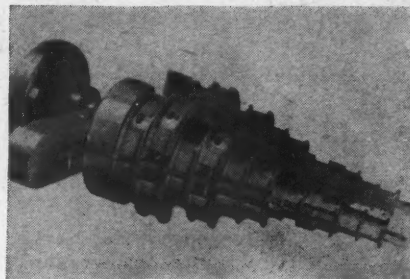


FIG. 2—View of concentric head showing adjustability of individual segments to secure proper coil span.

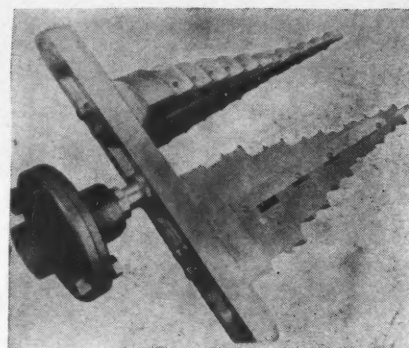


FIG. 3—Each half section of the head can be turned 90 degrees on the holding bar to facilitate transverse adjustment of step segments.

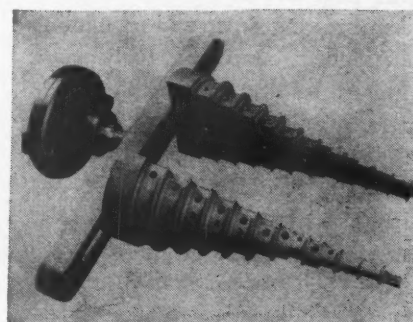


FIG. 4—The complete winding head, ready to be used.

listing settings for practically every standard fractional and small integral horsepower motor. By referring to this chart and adjusting the necessary screws on the head, he can clip from five to ten minutes from the set-up time required on concentric winding heads. The head will automatically wind a flat nosed or round end coil if required.

Although originally made of Kirk-site and steel, he is bulding one of the lighter metal to cut machining time.



## CUSTOM-BUILT INSTALLATIONS

## MADE EASILY WITH GREENLEE BENDER

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Here is just another example of the manpower and materials savings made possible with a GREENLEE.

It's one-man-operated to quickly produce smooth, accurate bends in pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars. Easy to set up and operate right on the job. Get complete facts today. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1744 Columbia Avenue, Rockford, Illinois.

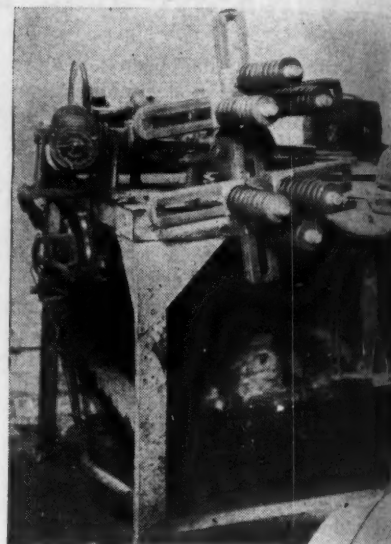


### OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK

Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers

## Coil Winder

A coil winder using standard winding heads, has been built by the Thomas Electric Co., Salt Lake City. The "works" to the rear as shown in the photograph, consist of a one hp. motor belted to an old sewing machine clutch assembly. This in turn drives



Thomas Electric Co. Coil Winder

the winding shaft by means of a gear reducer head, the revolution counter being driven from the final gear in the reducer.

The regular speeds are available, by changing the motor pulley, other variations also being possible by merely slipping the clutch. The brake mechanism, pedal controlled, is located in the clutch.

## Turntable For Rotor Storage

Latest addition to the shop equipment at Spaulding Electric Company, Detroit motor repair specialists, is a triple-deck turntable providing storage facilities for 32 rotors ranging from 20 hp. down. Capable of holding four tons, the unit (Fig. 1) occupies less than 31 sq. ft. of floor space; has a net weight of 1600 pounds.

Designed and constructed by Spaulding's shop superintendent, George C. Glenning, the device consists of three turntables of different diameters on a shaft (over-all height, 87 inches) which rotates in a heavy collar at the floor base. Pedestal assembly consists of a 38-in. diameter section of ¾-inch boiler plate to which is welded a 12½-in. piece of 8-in. dia. (O.D.) steel tubing (¾-in. thick) with four triangular boiler plate braces. Bottom end of this



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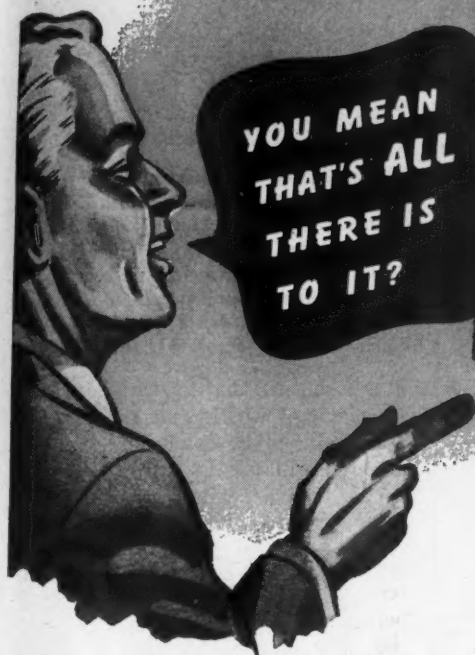
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The fact that GEDNEY fittings have been on the "best seller" list with mechanics who know fine accessories is proof enough of year in—year out excellence. Check the other features in the panel at left. They highlight the points about GEDNEY fittings that mean money in the bank for "live wire" wiring men.

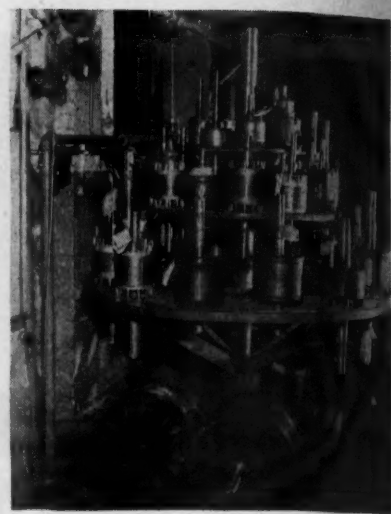
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**FIG. 1—Triple-deck turntable provides maximum rotor storage facilities in a minimum of floor space. Unit holds 32 armatures ranging up to 20 hp., 1200 rpm. in size; weighs about 1,600 pounds; takes a maximum loading of about 8,000 pounds. Total floor space required: less than 31 square feet.**

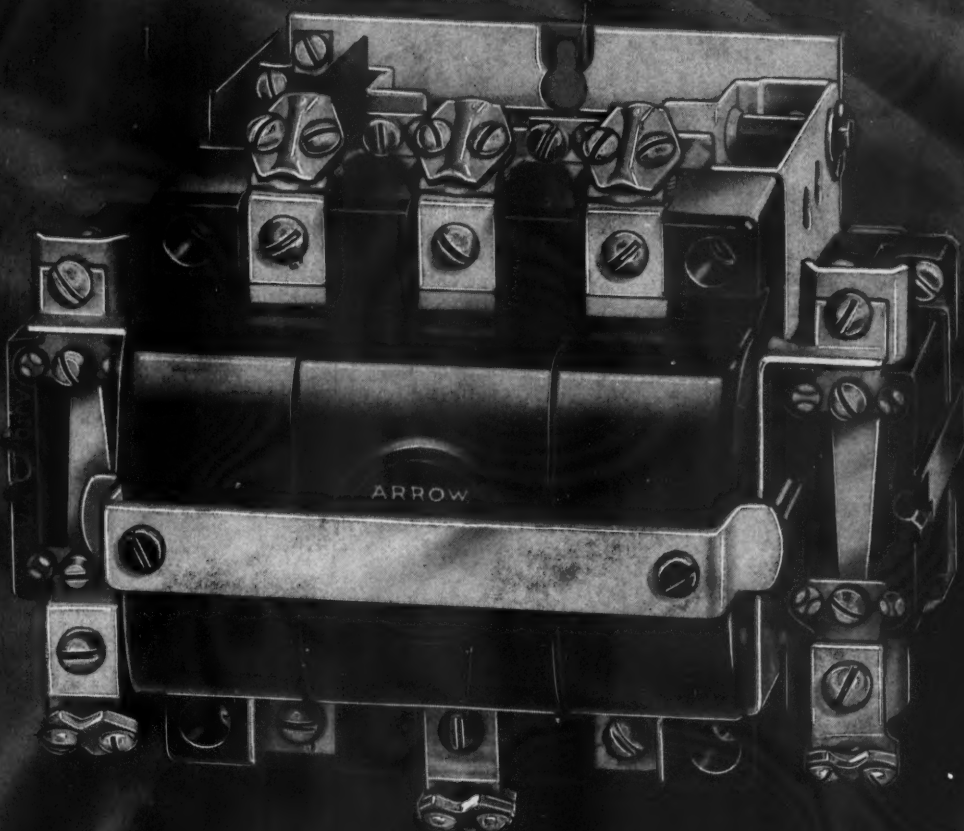
collar is bushed and top end bored for ball bearings which seat the rotating shaft (3-in. black conduit).

Each turntable is a separate unit built around a 3½-in. dia. pipe sleeve which fits over and is pinned to the rotating shaft by a through-bolt. The bottom table (largest) has a 66-inch diameter ring of 2-in. dressed yellow pine (14-in. wide) bolted to six spokes of 4-in. light weight steel channel welded to the sleeve. Six 3-in. channel braces under the spokes increase the maximum loading of the table which can take 12 armatures up to 20 hp., 1200 rpm. size. Rotors stand on end with shafts extending through 4-in. diameter holds, the wood surface preventing damage to rotor ends. Height of the bottom turntable is 33 inches above the floor, a feature that simplifies transfer of completed rotors from shop rolling tables.

The sleeve of the second turntable rests on that of the first; has six 3-in. channel spokes that support a 42-in. diameter wood ring (9-in. wide) 15½ inches above the bottom table (top to top). A total of 12 3-in. diameter holes accommodate up to 7½ hp., 1200 rpm. rotors. The third sleeve has four channel iron spokes supporting a 24-in. diameter shelf of ¾-in. plywood. Positioned 11½ inches above the second table, it has eight 2-in. holes for armature storage.

One precaution was necessary. That was the setting of the unit directly over a floor beam capable of sustaining the weight (might reach better than 4½ tons with maximum loading). Hence the location of the unit near a wall column at the side of the second floor shop area.





# NEW MAGNETIC STARTER

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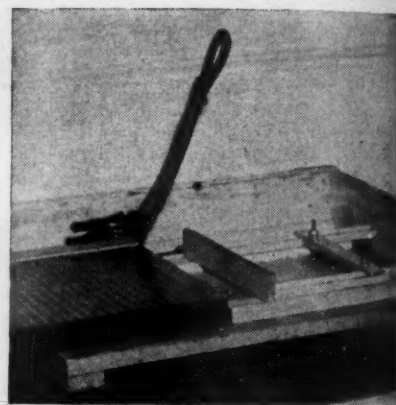
**BRIGHT LIGHT REFLECTOR CO. INC.**  
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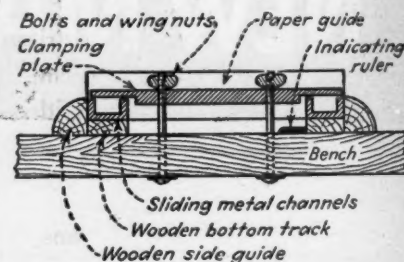
## Width Guide For Slot Paper

In the absence of an automatic width indicator, paper for insulating winding slots is usually cut wider than necessary and trimmed to exact size after the winding operation has been completed. This necessitates a second operation of cutting and also wastes a certain amount of paper.

An idea applied in the shop of the Mo-Gen Electric Company of Stamford, Conn., utilizes a standard photographic paper cutter and a shop-designed, rapidly adjusted paper width



Insulation paper is cut to exact width by using standard photographic cutter and a shop-designed guide. Later cutting to exact requirements is unnecessary and paper is saved by this simple device.



Rear elevation of guide looking towards guide plate indicates construction details of side and bottom guides, clamping plate for locking the stop-guide in position and the wing nuts which lock the clamping plate. The U-shaped metal channels are brazed to the paper guide or stop-plate and they slide towards or away from the cutter blade in the wooden tracks.

guide. The paper is slipped under the blade until it strikes this guide and the knife cuts even, identical strips. The guide slides towards and away from the knife blade in wooden grooves, is fixed in position by merely turning two wing nuts, and indicates the distance between guide and blade on a stationary ruler below and at right angles to the cutting edge. The accompanying picture and sketch shows the guide in use.



# Modern Lighting

## Offices Use Semi-Direct Fluorescents

The fourth floor of the Standard Building in Cleveland is lighted throughout with semi-direct fluorescent lighting units. This floor is occupied by Thompson Products, Inc., and embraces approximately 17,500 square feet of floor space. The accompanying photograph shows a typical general office area on this floor, and

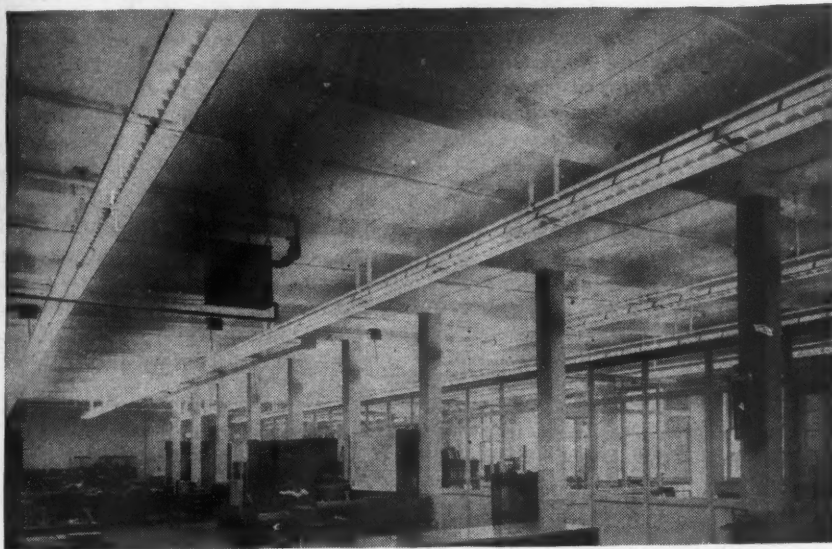
the floor plan shows the typical lighting layout used throughout.

The Wakefield "Grenadier" fluorescent unit, installed in continuous rows, was used to provide an average illumination of approximately 40 foot-candles uniformly on the working plane. In the area shown, five rows of equipment are equally spaced in the

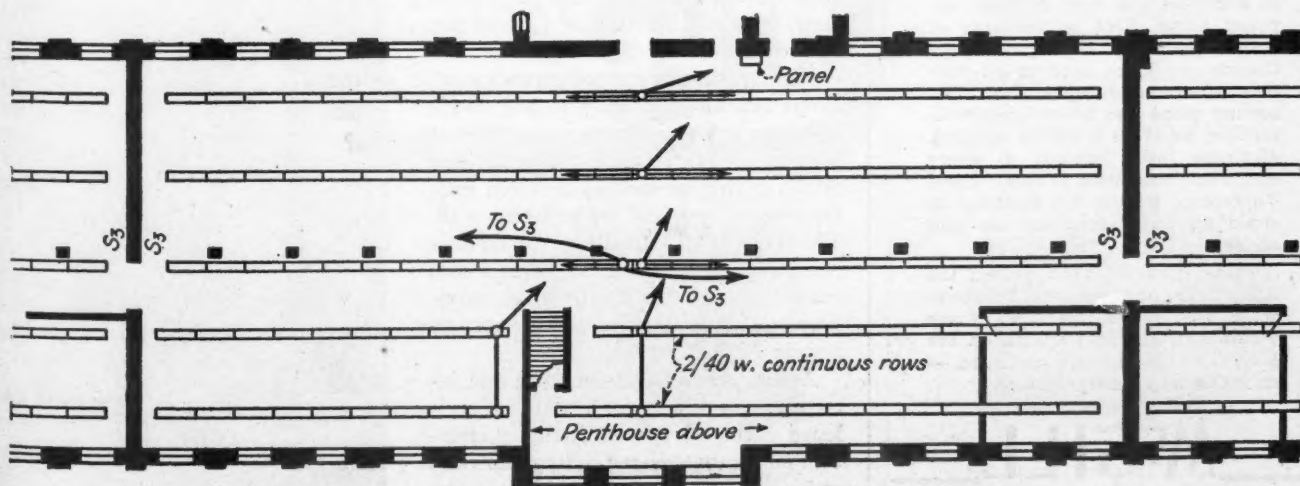
40 foot wide room. The rows running the full length of the room each have 24 standard four-foot long units, connected end to end, to provide a continuous line of equipment. As can be noted in the photograph, this equipment is attached to standard  $\frac{1}{2}$ -inch conduit. The conduit in turn is supported to the ceiling by means of steel straps attached to ceiling beams. Conduit and straps are painted the same color as the ceiling.

Each four-foot "Grenadier" unit uses two 40 watt 3500° white lamps. This unit is a semi-direct type, open both top and bottom. The narrow openings at the top, over each lamp, permit enough light upward to light the ceiling softly. Bottom of the unit is equipped with cross louvers which shield the lamps from the eyes of the workers. The curved sides of the unit are of plastic, which provide shielding of lamps normal to the fixture, and also act as reflectors to direct a high percentage of the light downward to the desk top. Footcandle readings were taken after 400 hours operation, and averaged 38 footcandles.

This planned lighting layout was made by John Paul Jones, Cary & Millar, consulting engineers of Cleveland. The Parker Electric Company, Cleveland, were the electrical contractors on this project.



**Fig. 1—Typical view in offices of Thompson Products, Cleveland, showing continuous row fluorescent lighting. Intensity of 38 foot-candles results after 400 hours of operation from 2.94 watts per square foot.**



**Fig. 2—Lighting layout was planned by John Paul Jones, consulting engineer. Installation was made by Parker Electric Company. One ceiling outlet is provided for each continuous row unit.**

# —MCGILL—

## Safety Vaporproof GUARDS...with Tight-sealing Globes



Approved by  
Underwriters



### Safeguard Life and Property

Where there is a possibility of fire, or other disaster from a spark, exposed flame, heat or breaking of bulbs, then McGill Vaporproof Lamp Guards should be used on all portable or extension lights. The tight-sealing globe and heavy cage, with air-tight seal in handle opening, eliminate these hazards at every spot where this guard is used. These Vaporproof guards are designed to stand up under roughest use and abuse.

These guards also protect the light bulb and prevent breakage when used around machines where water and oil might splash on the bulb. Guards also are grounded — an additional safety feature.

—MCGILL—  
**MANUFACTURING CO., INC.**  
Electrical Division  
VALPARAISO, INDIANA



*General illumination is furnished by continuous rows of standard industrial fluorescent fixtures housing four 40-watt white lamps per unit and delivering 50 footcandles of lighting intensity to foot levels. Pattern of downlights, consisting of 300-watt incandescent lamps recessed behind flood lenses, raises light level to average of 70 footcandles. Scalloped cornices relieve ceiling contrast and fluorescent strips light local merchandise areas and sales displays.*

## Combined Sources In Lighting Plan

Surface mounted standard fluorescent fixtures furnish diffused general lighting while recessed 300-watt incandescent downlights build higher intensities in those areas where merchandise is most critically examined by prospective customers of Leeds Shoe Store, Los Angeles. Dividing the ceiling into longitudinal thirds, two continuous rows of Solar URC fluorescent units mounted end to end extend from front to rear, providing an average of 50 footcandles on shoe rests. Each fixture houses four 40-watt white fluorescents, and 23 units are combined in each row. These 46 fixtures, mounted 16 feet above the floor, consume a resultant 4 watts per square foot.

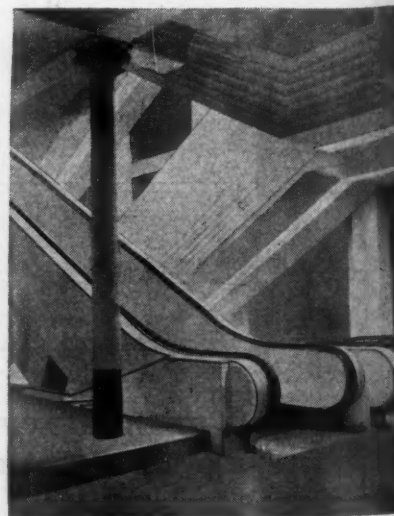
Three rows of recessed incandescent lamps run longitudinally to add punch lighting. These units, on 10-foot centers, are placed along the center line of the ceiling as well as between each fluorescent row and its adjacent wall. The downlights, equalling the fluorescent general lighting in square-foot consumption, raise the lighting intensities on shoe-sales areas to approximately 70 footcandles.

Across the rear of the store and intermittently along each wall, a scalloped cornice hides additional fluorescent lamps that relieve ceiling contrasts and augments general illumination by reflection. Wall displays are locally illuminated, again by continuous rows of fluorescent white light.

Modernistic chairs are for customer comfort and the general decorative treatment includes broadloom carpeting, veneer-paneled counters, liberal use of mirrors and neatly-recessed stock boxes. The overall effect, paced by the planned lighting combinations, is one of restful informality.

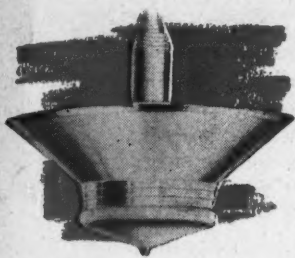
## Lighting for Escalator Installation

This photograph does not represent some cubist's conception of a nude figure, but is a rather unusual example of escalator lighting in the Z.C.M.I. department store in Salt Lake City.

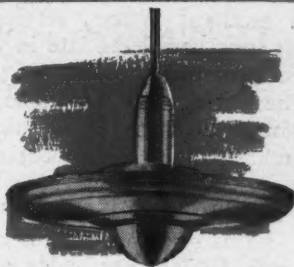


**Fluorescent lighting for the new Z.C.M.I. escalator.**





**SUPER-ILLUMINATORS**, smartly designed, efficient, Indirect Luminaires with luminous glass bowl and softly lighted exterior. (3-sizes.)



**WINDSOR**—Provides wide light-distribution of Indirect Lighting with pleasant bottom light-spill. Excellent for low-ceilings. (2-sizes.)



**OPTILUX**—Enclosed Indirect with low-brightness glass reflector-cover. Ideal for Schools and Hospitals. (2-sizes.)

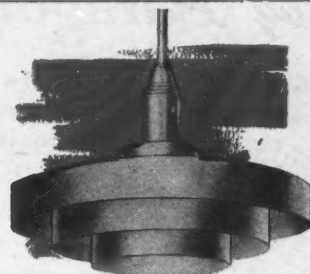
# ***NOW*** **A Definite Line of** ***Guth*** **INCANDESCENTS**

Although Fluorescent Lighting makes up by far the major portion of our business today, we are nevertheless, producing a great many Incandescent Lighting Fixtures as well. The demand for Incandescent Fixtures is still excellent. Illustrated here are a few of the many types of GUTH Incandescent Fixtures included in the complete line. Our Catalog 44-A illustrates and describes a wide variety of types and sizes. Our current policy is to confine production strictly to the items shown in Catalog 44-A. We are not producing any other types shown in earlier catalogs. By so doing, we can assure you of better production and delivery schedules than would otherwise be possible. Write for Catalog 44-A today. It includes the full line of present day GUTH Fixtures . . . both Fluorescent and Incandescent.

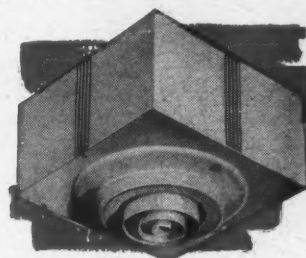


**THE EDWIN F. GUTH CO.**  
**ST. LOUIS**

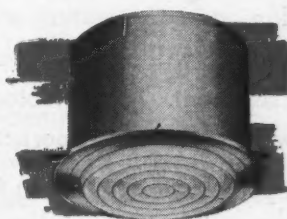
*Leaders in Lighting Since 1902*



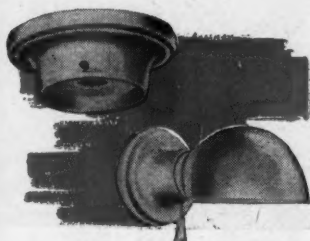
**"THREE RING SB"**—Totally Indirect Luminaire for Silver Bowl Lamps affords good maintenance. (2 sizes in 2 types.)



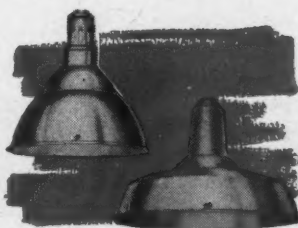
**HYLITERS**—Recessed and Surface types for Projector Lamps (PAR 38). Can be used as individual units, or in conjunction with our Fluorescent types.



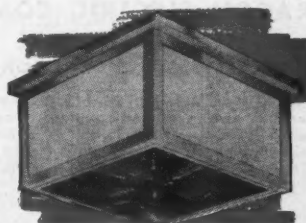
**RECESSED UNITS**—With Genuine Alzak reflector. In 2 sizes. Various bottoms include: Open, flat sanded-glass, Louvre Lens, Concentric Louvres, Wire Guard, etc.



**AGLITES AND FLANGES**—Aglites are high quality all-around utility units; Flanges have self-adjusting spring glass-holders. Both are formed of steel and finished 300° White Enamel.



**INDUSTRIAL REFLECTORS**—Dome and High Bay reflectors. Four Dome sizes and 9 High Bay Types. All made of Alzak Aluminum.



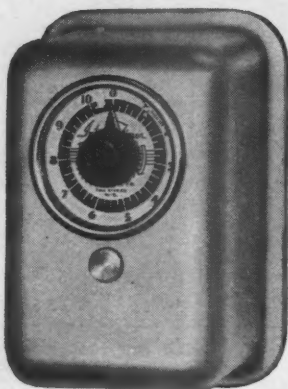
**PRISMATIC LENS UNITS** — Recessed and Surface types with heat-resistant PYREX lenses. Surface type has opal glass sides.

## EXTRA PROFITS

*with attic and  
window*

## fan controls

*by Paragon*



- Two time ranges... 0 to 10 hrs.; 0 to 20 hrs.

- Telechron motored... quiet; no ticking, self-starting, synchronous.

- Underwriter's approved for 115 V. A.C., ¾ H.P. loads

... accurate and dependable.

- Easy to install, direct to handy box or surface mount with conduit connection through bottom of timer.

For extra profits this spring and summer, get set to install these new timers, now. They work with any A.C. fan, and the setting may be changed at will without harming the instrument. Timer motor runs only when timer is in operation.

List price only \$9.75 F.O.B. Two Rivers . . . an outstanding value.



Order from your jobber now . . . and ask for Sales Aids.

**PARAGON ELECTRIC COMPANY**

1614 TWELFTH STREET

TWO RIVERS . WISCONSIN

Since 1905 Paragon Electric Company has planned, designed and manufactured Time Switches, Industrial Timers and other time control instruments. Paragon now makes everything going into its products except the motors . . . which are Warren Telechron.

**Paragon** *Two Rivers*  
WISCONSIN  
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

The escalator system, serving three floors, was completed late in November at a cost of \$300,000.

The wiring job was done by the Wasatch Electric Co. of that city, though the fluorescent tubes and fixtures were supplied by a local manufacturer. Wasatch ran the power into the main service of the escalator through 500,000 c.m. cable and 400-amp. main switch, furnished and connected the two 12-hp. and two 19-hp.

motors required and ran all the wiring for the lights. Their contract amounted to approximately \$5,000.

All lights are recessed and glass covered. On the first two floors, two 40-watt fluorescents are installed per 4-ft. section, with a few 15- and 20-watt for fill-ins. On the third floor, four 40-watt fluorescents are used per 4-ft. section and in addition there is one large ceiling unit at that point, to supply additional lighting.

## Lighting Included With Construction

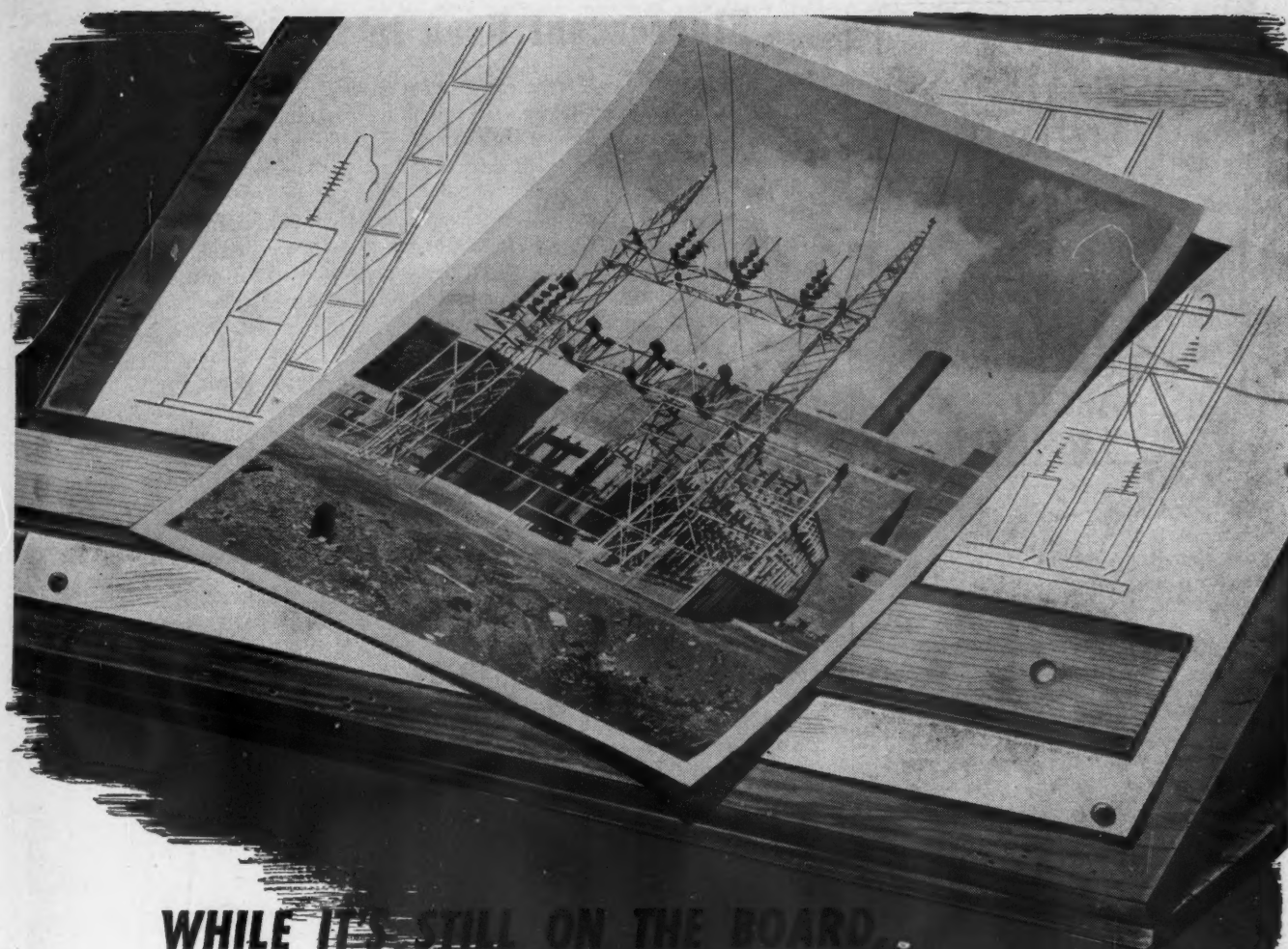
Lighting has made tremendous strides in improved illumination sources, design, efficiencies and functionalism. Whereas lighting was once installed after architects and decorators had completed their designs, illumination is now an integrated component of creative planning and new trends are planning interiors, new construction and alterations with lighting as one of the motivating thoughts. With the introduction of new fixture hanger assemblies, the installation of lighting now not only becomes incorporated with construction but actually becomes the framework from which suspended ceilings are hung. The lighting of the Manning Bowman and Company's Meriden, Conn., table appliance store, created by The Miller Company, also of Meriden, is an example where a Celotex furred ceiling was suspended from ceiling hangers designed to support both fixtures and ceiling.

The showroom, irregular in shape and lighted by Miller fluorescent troffer units hung singly and in pairs, has a 10 foot 9 inch ceiling. In the section pictured in the accompanying photograph, fixtures are mounted in pairs with a gap of 18 inches between runs and 8 feet between rows. Shallow dish panels of plastic are mounted in hinged steel frames which swing downwards for maintenance and replacement of lamps. The slight protrusion of each panel from the frame and the ornamental ribbing diffuses the light and transmits high angle illumination to the ceiling. The contrast between troffers and intervening ceiling areas is minimized and abrupt changes in light values are eliminated. Each troffer contains two 40 watt white fluorescent lamps, resulting in average counter-top intensities of 30 footcandles and an average consumption of 2.7 watts per square foot.



In the Manning Bowman table appliance store, an acoustical tile ceiling is suspended from patented hangers designed by the Miller Company to support both lighting fixtures and ceiling panels. Two-lamp fixtures, installed singly and in pairs, utilize 40 watt white fluorescent lamps and deliver an average of 30 footcandles of lighting intensity to counter tops.





WHILE IT'S STILL ON THE BOARD,  
BUILD IT ***ALL*** WITH ALCOA ALUMINUM

Specify the framework and supports of Alcoa Aluminum strong alloy structural shapes. Their light weight reduces fabrication and erection costs. There'll be no expensive and hazardous painting jobs.

Use Alcoa Aluminum Bus Conductors for the current-carrying members. They are light and easy to erect. Choose between round and square tubing, flat

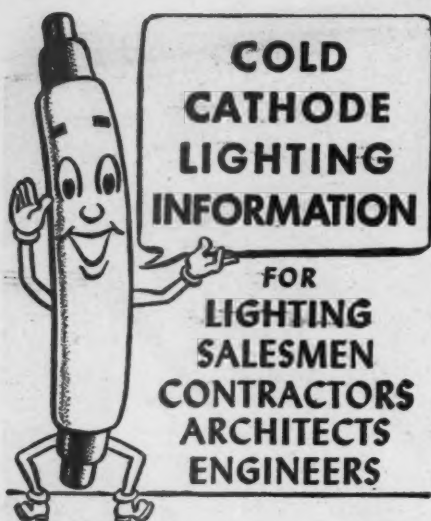
bars, angles, and channels. There are Alcoa Aluminum Fittings to make efficient joints, angles, and tap-offs.

When you design your next substation, make it *all-aluminum*. We'll gladly furnish literature and engineering advice. ALUMINUM COMPANY OF AMERICA, 2197 Gulf Building, Pittsburgh 19, Pennsylvania. Sales offices in leading cities.

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For commercial or industrial installations

## \*COLOVOLT

Cold Cathode Low Voltage Lighting offers these extra advantages

- Longer lamp life...one year guaranteed
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- Engineered for individual or line lighting

Write for Illustrated Material and Technical Data today!



Architectural and Engineering Files for 1947

\*Trade Mark Registered U.S. Pat. Off.



## Fluorescent Used In Drafting Room

The Engineering Department of Adamson United Company, Akron, Ohio, has been lighted to an intensity of over 50 footcandles of well diffused and uniform intensity fluorescent illumination. Annoying shadows from straight edges, T-squares and triangles have been practically eliminated by installing the continuous rows of units close together, and at a 45-degree angle with the sides of the room.

A total of 106 Wakefield "Grenadier" units, each containing two 40-watt 3500° white fluorescent lamps, were used in this job. The units were installed in continuous rows, and

spaced 5 feet 6 inches apart. They were mounted on the white acoustical tile ceiling, 10 feet 6 inches from the floor. The Grenadier units have semi-direct distribution of light, which permits enough light to be directed upward to the ceiling to light it softly, and relieve the contrast which would obtain against an unlighted ceiling. The intensity, measured after 100 hours of operation, averaged 58 f.c.

The lighting for this drafting room was planned by the Ohio Edison Company and was installed by Carle Electric Construction Company, electrical contractors, both of Akron, Ohio.



Wakefield "Grenadier" 2-40 watt fluorescent units provide nearly 60 footcandles in this drafting room at Adamson United Company, Akron, Ohio. Continuous rows are spaced 5 ft. 6 in. apart and installed diagonally across the ceiling to eliminate shadows along straight edges.

## Stadium Lighted To NEMA Standards

Western Stadium, Bowling Green, Ky., has been illuminated to the new NEMA standards for Class A fields. General Electric's high-efficiency Type L-69 sports floodlights were used.

Seven towers support the 144 floodlights for the stadium. Because of the unsymmetrical characteristics of the opposite sides of the field, the towers were made to vary in height to produce an even level of light on the playing field.

On one side of the field are four 80-foot towers, each mounting 18 L-69 floodlights. On the other side are three towers of varying heights; one is 60 feet high, situated on a natural rise of 31 feet. Another is 80 feet high, located atop a 23-foot natural rise; the third is 100 feet high. Each tower supports 24 floodlights.

The stadium's primary service is 3-phase, 2300-volt, 60-cycle. Two circuits of No. 6, 5,000-volt Flamenol street lighting cable, totalling 9,000

feet, are used in the installation. The three 24-light towers each use 37.5-kva. transformers, and 25-kva. transformers are used for each of the 18-light towers. Primary fused cut-outs are used for each transformer.

A 24-circuit fused panel is mounted on each tower, with a 25-ampere fuse for each light. This facilitates overall adjustment, and provides maximum protection for the lights. A 200-ampere, Class A fused safety disconnect switch was installed for each tower.

Two G-E Type FP-7 disconnect switches are used to control the two 2300-volt circuits. The two outside 18-light towers and the middle 24-light tower are on one circuit. In the event of an emergency, there would be no difficulty finishing the game on either circuit.

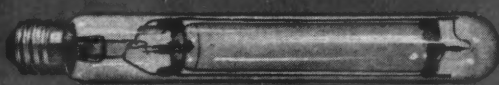
Western Stadium is shared by Western State Teacher's College and Bowling Green High School.



In this large assembly shop, 3000-watt mercury units are combined with three 1000-watt filament lamps to approximate daylight.



400-watt G-E mercury lamp. Life rating increased from 5000 to 6000 hours when burned 10 hours per start.



3000-watt G-E mercury lamp. Life rating increased from 2000 to 3000 hours when burned 5 hours per start.

## Now . . . 1000 Hours more life for G-E Mercury Lamps!

Now even greater improvements in industrial lighting are possible with General Electric mercury lamps. The 1000-hour increase in life ratings for both the 400-watt and 3000-watt lamps means a corresponding reduction in lamp renewal costs, with the same dependable illumination.

As you plan new industrial lighting jobs—especially those with high mounting in assembly shops, steel mills, foundries, etc.—be sure to make the most of these G-E mercury lamp advantages:

**1. HIGH EFFICIENCY**—Initial light output 40 lumens per lamp watt.

**2. SUSTAINED LIGHT OUTPUT**—Still 35 lumens per lamp watt at 70% of rated life.

**3. LOW MAINTENANCE COST**—High light output per lamp means fewer fixtures to service.

**4. LONG LIFE**—Up to 6000 hours rated life, depending upon wattage and number of starts.

Remember—*whatever lamps you need, G-E makes 'em all!* So you can always count on your nearby General Electric Lamp office as a reliable and unbiased source of information when it comes to lamp selection. General Electric Company, Lamp Department, Nela Park, Cleveland 12, Ohio.

# G-E LAMPS

GENERAL  ELECTRIC

IT'S  
WEATHERPROOF

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P&S 8008



## Check THESE FEATURES...

- P&S Porcelain Socket Interior.
- Die-cast Metal Shell — Baked-on Aluminum Spray Finish.
- 90° Angle Cap for ½" Conduit — Easily Installed.
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- Completely Weatherproof — for a Permanent — Sturdy Installation.
- Rating: 660 Watts, 250 Volts.

AVAILABLE FOR  
IMMEDIATE SHIPMENT

Keep Your P&S Catalog Handy.

PASS & SEYMOUR, INC.  
SYRACUSE 9, N. Y.



*Western Stadium at Bowling Green, Kentucky, is lighted in accordance with NEMA standards for a Class A field by 144 Type L-69 G. E. floodlights.*

## Good Lighting Aids Office Workers

Officials of the Ohio Machinery Company, Valley View, Ohio, believe in good lighting for any area where work is being done. The lighting installation in their recently completed plant bears testimony to this fact. Offices and the display room are lighted with high intensity levels of fluorescent lighting, while large single lamp incandescent reflectors were used to light the high ceiling area in the shop.

General and private offices were lighted with Wakefield "Grenadier" units, installed in continuous rows. These units were installed on seven-foot centers, and suspended on 12-inch hangers to permit the small indirect component of light to softly

illuminate the ceiling. An intensity of 50 footcandles average results.

Lighting requirements were given prime consideration by Harold N. Graves, president, and other company executives, when the plans for their new building were being drawn. Thus adequate provision for electrical service for lighting and power were incorporated into the building plans and specifications, and made a part of the electrical contract. They are well pleased with the lighting results obtained, and report improved worker morale, with sufficient illumination for efficiency, safety and satisfaction.

Harrington Electric Company were the electrical contractors on this job,



*General office area in the new Ohio Machinery Company building, Valley View, Ohio, is lighted to an intensity of over 50 footcandles with Wakefield "Grenadier" continuous row fluorescent fixtures.*



# In the News

## Elimination of Escalator Clause Urged by NECA

Forecasts of a \$20 billion construction year will be unfilled in 1947 unless the upward flight of building cost is halted immediately, the National Electrical Contractors Association said recently, suggesting that the first correction be to scrap all escalator clauses.

Return to a firm price and definite delivery schedule is the first requisite to any substantial reduction in building costs, NECA declared.

The escalator clause is a wartime pricing device possible to condone under war conditions but it has no place in a peacetime economy, NECA said. At this time, the Association declared, the escalator clause provides the principal means for construction to price itself out of the market.

In the past weeks there have been heavy cancellations of engineering construction contracts. Many scheduled for early spring were deferred. Some have been dropped entirely. Many an engineering architectural firm has shelves of blueprints of projects of vital importance to the American industrial plant and to the nation's health and educational facilities gathering dust. They represent hundreds of thousands of dollars worth of effort. Present high cost conditions are destroying this planning and this investment.

With this in mind, NECA's Administrative Committee at a recent meeting in Kansas City, Mo., considered as of paramount importance the matter of high building costs and escalator clauses. The Committee, composed of the Association's officers, including its six Divisional Vice Presidents and the Chairman of its Labor Relations Committee, issued the following statement, primarily directed at the manufacturers who have persisted in not adhering to a firm price and definite delivery basis:

"Authoritative forecasts of a record twenty billion dollars worth of construction in 1947 are being threatened seriously by cancellation of proposed projects.

"Uncertain construction costs cre-

ated by escalator clauses are pricing building out of the market.

"Firm prices for and definite deliveries of materials are essential to economical building. Both are the obligation of the manufacturer.

"The wages of construction labor have been stabilized through yearly contracts. Productivity, however, is anything but stabilized because of uncertain material deliveries. It can never be controlled unless material can be scheduled to be on hand when required, thus eliminating lost time or slow down which make it impossible to obtain labor efficiency.

"Building will proceed in volume only when manufacturers stop imposing escalator clauses on prices of materials, and when they keep delivery schedules. When that condition is reached, contractors can make firm prices to owners.

"This, more than anything else, will release the tremendous pent-up volume of construction which will be required for our expanding economy. It is the only way the manufacturer can assure himself of a continuing market for his materials. It is the only way the logjam of blueprints can be shaken loose

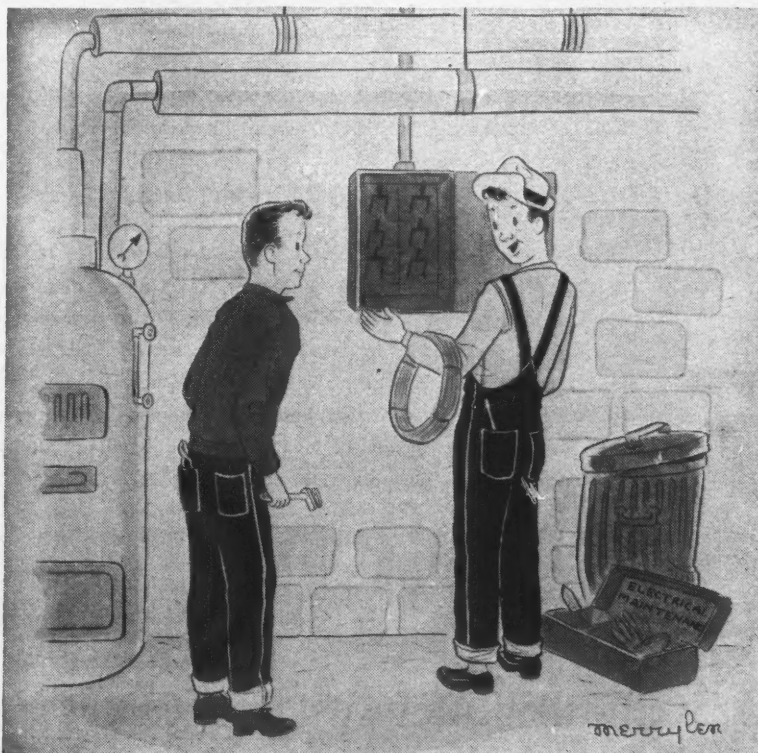
from the shelf of postwar projects in engineering and architect offices.

"Each contractor has in his own hand the most potent argument and most effective weapon for bringing about the necessary return of the industry to a normal firm price basis. He must continually insist upon and demand firm prices and delivery on schedule from his suppliers. In our industry it is urgently necessary that every electrical contractor, individually, use his influence to bring back stabilization to the industry by demanding and getting firm prices and definite delivery commitments from each supplier on every order."

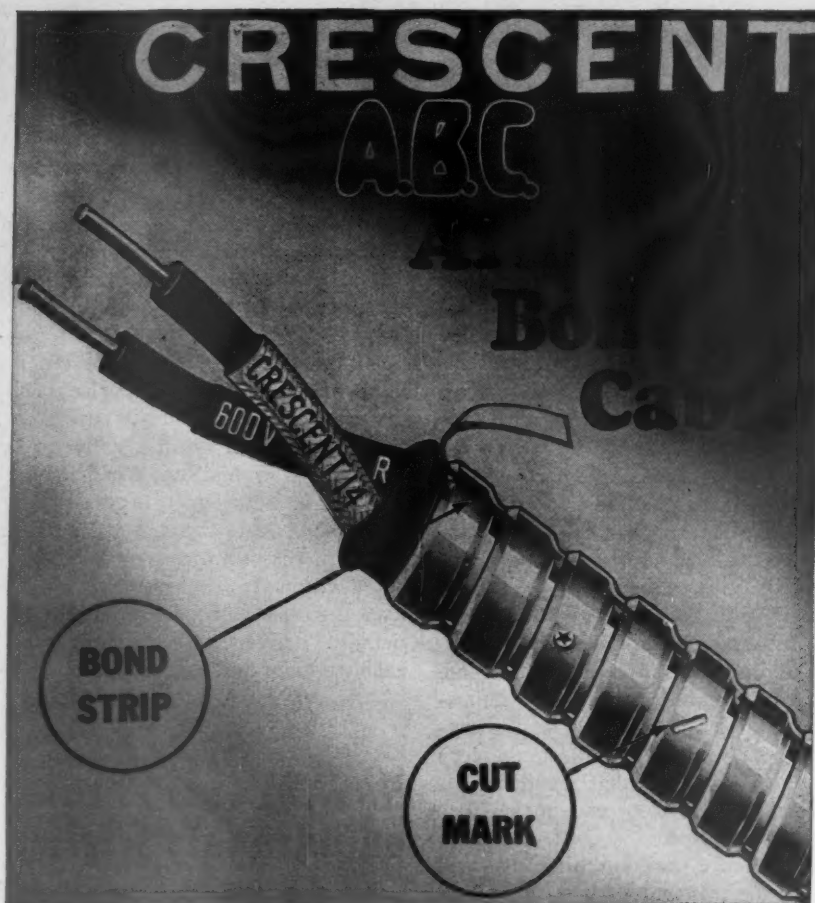
## NAWB Holds Forum on Adequate Wiring

More than 100 representatives of all branches of the electrical industry attended the annual Adequate Wiring Forum, sponsored by the National Adequate Wiring Bureau in Chicago, February 27th and 28th.

Panel discussions covered markets



"Let's turn off the lights in 402. Maybe the blonde will come down to complain!"



## Has Two Outstanding Advantages

### 1. BOND STRIP UNDER ARMOR

Permanently low armor resistance is provided in sizes No. 14 and 12 AWG by use of a flattened, tinned copper bonding wire which is in contact with the under side of each convolution. These sizes now are smaller and lighter, since they use the smaller diameter Type R conductors of the 1947 National Electrical Code.

### 2. PREFABRICATED BREAKING LINES

The Cut Mark (at 1½" intervals) shows the location of a prefabricated breaking line inside the armor. Only a few strokes of a file guided by the Cut Mark are required to cut through one outer ridge, and a bend by hand severs the armor. This results in a clean separation with no sharp edge—a safer, easier and faster job. The prefabricated breaking lines are so designed that there is no reduction in tensile strength, bending quality, crushing resistance and electrical conductivity of armor.



**CRESCENT**  
WIRE and CABLE



**CRESCENT INSULATED WIRE & CABLE CO.**  
TRENTON, N. J.

for adequate wiring, certification, electrical living and adequate wiring promotional activities.

In discussing market possibilities, Thomas S. Holden, president of F. W. Dodge Corp., estimated that 950,000 new homes would be built during 1947 and expressed the opinion that the light construction industry was now entering the anticipated phase of price stabilization, and that improved flow of material will tend to lower cost through eliminating delays in construction.

Eward G. Gavin, editor of *American Builder*, referred to the divided opinion among builders, on equipping houses in advance of sale with such appliances as ranges, refrigerators, and water heaters. The electrical industry, he pointed out, will have to cope with this division of opinion in advancing the acceptance of electrical living. Curt Mack, assistant commissioner, Federal Housing Administration, explained the manner by which eligibility of such appliances for inclusion in the mortgage is determined. He indicated that FHA, in appraising plans and specifications for homes submitted for mortgage insurance under its program, will give greater valuation to homes with adequate wiring installations provided the installation is detailed in the plans and specifications at the time they are submitted.

H. E. Seim, vice president and general manager of Bryant Electric Company, reviewed the present relationship of supply to demand for wiring materials and appliances, and presented estimates as to when manufacturers expect to reach a balance in each classification. By the third quarter of 1947, Seim predicted, shortages of most electrical products will have been eliminated.

B. T. Schecher, manager, Home Planning Department, Kansas City Power and Light Company; Burr H. Allen, manager, Adequate Wiring Bureau, of the Electrical Association of Detroit; and Finis F. McCoy, supervisor, Residential Service, Wisconsin Electrical Power Company, described past experience and current operations in the panel discussion on the Adequate Wiring Certification Plan. All were agreed that the current housing situation warrants immediate resumption of full-scale promotion of wiring certification.

Henry D. Edmiston, assistant vice president, National Life Insurance Company of Vermont, discussed the advantages of the "packaged mortgage" plan as a means of financing appliance sales in new homes during the panel on electrical living. P. N.



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Varnishes*

The higher dielectric strength and longlife of Pedigree Insulating Varnishes are acclaimed by engineers and shopmen from coast to coast. Their superior mechanical, thermal and chemical protection make them first choice of the industry.

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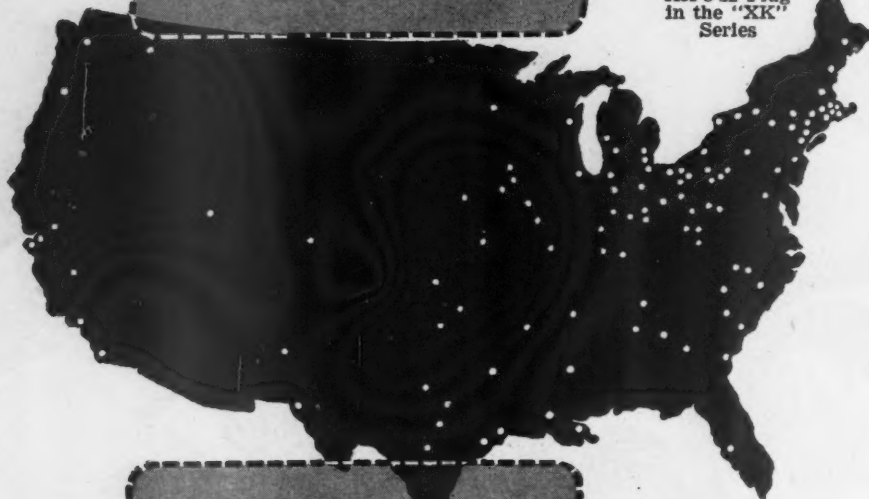
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*Now you can  
buy all these  
**CANNON**  
plugs receptacles  
and accessory fittings*



*-in 6 type series  
from more than  
125\* distributors*

To make it easier and quicker to obtain fittings in the above illustrated Cannon Electric Type Connector Series, more than 125\* radio and electrical distributors can fill your requirements. Many of these distributors carry stock items on their shelves for immediate delivery. They are ready to serve you and discuss your requirements. Contact them first.

These type series are widely used on microphones, sound equipment, in radio and electronic devices. Their quality and performance are assured by Cannon Electric's thirty-two years of continuous operation under the same management.

For a complete list of Representatives, Distributors and a Catalog covering these lines, write for Bulletins CED and RJC-1, Address Dept. D-231.

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in the "XL"  
Series



X-3-11 Plug  
in the "X"  
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XK-3-12 Plug  
in the "XK"  
Series



O3-11  
Receptacle  
in the "O"  
Series



TQ-1-12 Plug  
in the "TQ"  
Coaxial  
Series



P3-CG-12  
Plug in the  
"P" Series

\*Additional distributors  
are being added  
in certain states.

Fleck, home electrification counselor, Buffalo Niagara Electric Corporation, and H. P. Fiens, director of field sales, Omaha Public Power District, supported the merits of the "packaged mortgage" approach by citing actual experiences in the successful promotion and sale of fully-equipped all electric homes in their territories.

The feature of the panel on promotional activities was a talk by Walter C. Brown, sales representative, Public Service Company of Indiana. Mr. Brown outlined the program which he has been presenting for several months before consumer groups throughout central Indiana where, through the use of slides, a projection type light meter and panel displays, he demonstrates dramatically the contrasts, in terms of convenience and efficiency, between adequate and inadequate wiring. Also participating in this panel were Karl M. Joens, account executive, of Allen & Reynolds, Omaha advertising agency, who discussed the relationship between advertising and promotional activities on wiring, and R. V. Main, supervisor, of Cleveland Electrical Illuminating Company's Home Planning Bureau, who described the activities of his company where wiring promotion is integrated with each phase of its residential activities.

Moderators included P. N. Fleck; H. P. Wilson, secretary-manager of Electrical Institute of the Tri-Cities and mayor pro-tem of the city of Rock Island, Illinois; C. H. Christine, secretary-manager, St. Louis Electrical Board of Trade; and A. H. Kessler, promotion manager, North Central Electrical Industries.

H. E. Merrill, product promotion manager, of General Electric's Wiring Devices Division and chairman of the Plan Committee of the National Adequate Wiring Bureau, opened the meeting with an address of welcome. Herbert E. Cook, Detroit Edison Company, acted as general chairman of the forum.

## Pension Program For Contractors

The commissioner of Internal Revenue has informed the National Electrical Contractors Association that the industry-wide pension program for the electrical contracting industry conforms to Treasury regulations and that payments into the fund are properly deductible as items of business cost.

The ruling makes possible the start in the near future of the Employees Benefit Agreement under which re-



**CANNON ELECTRIC  
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# *All-bright* DUAL LIGHTING FOR DYNAMIC DISPLAY RIGHT SPOT UNITS

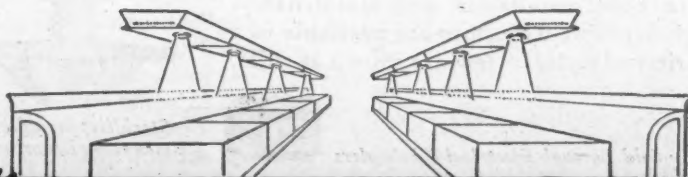
**The Floodlight or Spotlight an  
Integral Part of the Unit**

ALL-BRIGHT high "Lights" the 1947 electrical industry with the new RSU dual luminaire. RSU is a space-utilizing unit designed for dynamic display with incandescent floodlight or spotlight and for efficient illumination with modern fluorescent lighting.

(Illustrated are an 8 foot RECESSED RSU  
and a 10 foot SURFACE MOUNTED RSU)

To glamourize with fluorescent light, to feature merchandise in dramatic floodlight, to achieve dynamic display—install ALL-BRIGHT'S new dual luminaire, RIGHT SPOT UNITS.

SEND FOR ILLUSTRATED FOLDER



*All-bright*

ELECTRIC PRODUCTS COMPANY

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Union Made I.B.E.W.



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*Simple Twist...*

**FOR BETTER LIGHTING**

### Goodrich Seprable Reflectors

A quarter turn! That's all it takes to attach or remove the Goodrich Seprable Reflector.

To install, you merely wire the socket and snap it in the hood. Reflectors are attached later. No tools are needed.

They're easier to service, too—with complete "come-apart" construction of hood, socket and reflector. Resilient socket cushions lamp against vibration. And it's replaceable at trifling cost.

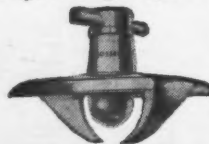
Simple? Sure—a twist that saves time and money in both installation and maintenance. Goodrich Seprable Reflectors are available in a wide variety of styles. A few are shown at right.



*Emblem Sign Reflectors*



*Keystone Sign Reflectors*



*Stocklites for efficient stock room illumination*

*Sold Through Electrical Wholesalers*



**GOODRICH**  
ELECTRIC COMPANY  
4600 BELLE PLAINE AVENUE, CHICAGO 41, ILLINOIS

tirement benefits of \$50 a month are provided to members of the International Brotherhood of Electrical Workers when they reach 65 years after 20 years of continuous membership in the union.

The program affects more than 2,000 electrical contractors located in all parts of the country and approximately 150,000 members of the IBEW. The fund is provided through a specified contribution by each member of the union with this sum matched dollar for dollar by an employers' contribution equal in amount to 1 per cent of the gross labor payroll paid by electrical contractors to members of the IBEW.

The payroll assessment will be collected locally from each electrical contractor. The collection will be remitted to a board of trustees known as the National Employees Benefit Board for the Electrical Contracting Industry. This board consists of 15 members—seven appointed by NECA; seven by the IBEW, and one by the Secretary of Labor. No member receives compensation.

The Board will make quarterly payments to the Pension Fund of the IBEW, which has been operating for almost 20 years. These payments are to be an amount equal to the total amount paid into that fund by all members of the Brotherhood for the same quarter.

Coincident with the Treasury announcement today the names of the NECA and IBEW members of the National Employees Benefit Board were announced. For NECA the members are E. C. Carlson, Youngstown, O.; A. L. Bush, New York; W. E. Frazer, Philadelphia, Pa.; D. B. Clayton, Birmingham, Ala.; J. N. Pierce, Chicago, Ill.; L. T. Allen, Tulsa, Okla., and T. L. Rosenberg, Oakland, Calif.

Members for the IBEW are: D. W. Tracy, International President of the IBEW, Washington; G. M. Bugnizet, International Secretary of the IBEW, Washington, D. C.; C. M. Paulsen, Chicago; H. H. Broach, Chicago; C. J. Foehn, San Francisco; C. E. Caffrey, Springfield, Mass., and C. R. Carle, Shreveport, La.

Just when the actual mechanics of collection begin will be determined at an early date by the NEBB.

In approving the payroll assessments as deductible items of business expense, the Commissioner of Internal Revenue ruled that sums thus exempted must actually be used by the NEBB to provide for the designated retirement benefits and for no other purpose. Benefits paid are to be taxed to distributees in accordance with provisions of Section 165 (b) of Code.



# MAKE SAFE HOUSE SERVICE CONNECTIONS WITH

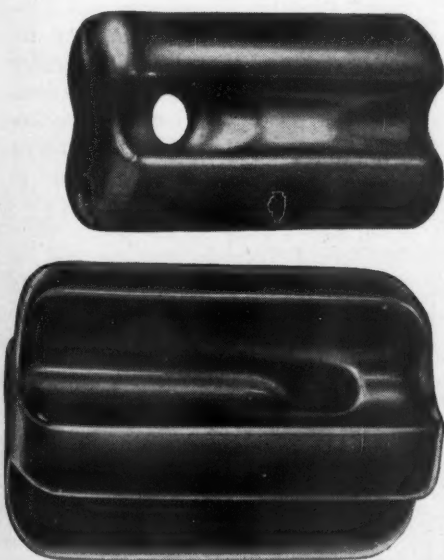
# ILLINOIS

## *time-proven quality*

### PORCELAIN WIREHOLDER INSULATORS

Made in sufficient styles and sizes to meet all requirements, these dry process wireholders have rounded corners to prevent injury to the wire insulation. The all-steel screws are hot galvanized by a process that gives them a smooth, even coating. They have deep, sharp threads for easy installation, are fastened into the insulators with non-shrinking metal alloy. No rust streaks on the sides of buildings will occur. Wet process porcelain supplied on special order.

### ILLINOIS WET PROCESS GUY STRAIN INSULATORS . . .



Deadends the service lines against the house in the case of heavy lines

Only materials that meet our high specifications are used so that we can assure top quality wetprocess guy strain insulators. Plant control guarantees the proper handling of the material — careful firing makes possible an insulator without internal stress. Large stocks of standard sizes are carried.

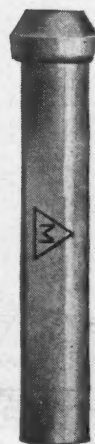


#### KNOB

Cement coated — extra length nail—genuine leather washer—code standard. They don't chip when driven in and they do stay in place and have a firm grip. Available in a wide variety of heights, diameters, holes, and grooves.

#### STANDARD TUBES

In sizes 1/2 to 48 inches long, 5/16 to 3 inches diameter in following types: unglazed, glazed, split, floor, split floor, headless, curved and, crossover split, and cross over. Diameters all uniform both inside and outside.



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# **SORGEL** **AIR-COOLED** **TRANSFORMERS**

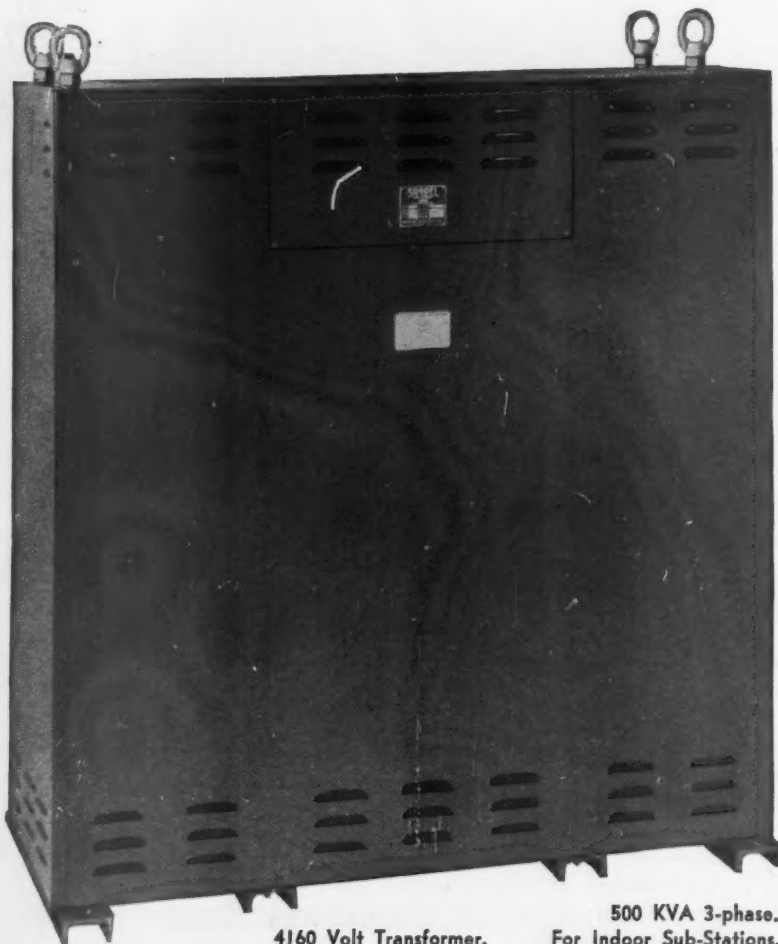
**are STEEL ENCASED**

**Rugged and compact.  
Built-in connection compartments.  
Solderless terminals.**

**1/4 KVA to 1000 KVA.  
All voltages.  
Single phase and poly-phase.**



**1/4 KVA.  
Single Phase  
460/230 to  
115 volt.**



4160 Volt Transformer.

500 KVA 3-phase.  
For Indoor Sub-Stations.

**SORGEL ELECTRIC CO., 836 W. National Ave., Milwaukee 4, Wisconsin**  
*Pioneers in the development and manufacturing of Air-Cooled Transformers*

## **Lighting Exposition Contest**

A competition of \$1200 in Merit Awards, designed to bring to the 2nd International Lighting Exposition, November 3-7, 1947, outstanding examples of "What Planned Lighting Can Do" in industrial, store, and office applications and in floodlighting and street lighting, was announced recently by the Exposition Operating Committee.

"Through these Merit Awards," the committee states, "we hope to give opportunity for electrical contractors, utility lighting men, architects, consulting engineers, and wholesalers' representatives not only to gain recognition for work well done, but, through the medium of display at the coming Exposition, to provide inspiration and ideas for Better Lighting to the thousands who will be in attendance."

The deadline for entries is August 31, 1947. Entries are to cover reports and data on the results of planned lighting installations made during the calendar years of 1946 and 1947. All submittals accepted by the Board of Judges will be placed on exhibit at the 2nd International Lighting Exposition and Conference, and will be given an Award of Merit. In addition, the Board of Judges will also award three cash prizes of \$100 each to the best entries from each one of the four classifications, a total of twelve cash prizes. Classification 1. Electrical Contractors; Classification 2. Utility Lighting Representatives; Classification 3. Architects and Consulting Engineers; Classification 4. Wholesaler's Lighting Specialists and Salesmen. The entire Merit Award Program is under the direction of the 2nd International Lighting Exposition and Conference, which is sponsored by the Industrial and Commercial Lighting Equipment Section of the National Electrical Manufacturers Association.

An official entry blank, containing the complete rules and conditions of the Merit Award competition, together with helpful suggestions for the preparation of entries may be had by writing to the International Lighting Exposition Award, Suite 818, 326 W. Madison Street, Chicago, Ill.

## **RECA Meets in New Orleans**

Approximately 150 builders of rural electrification lines attended the second annual convention of the Rural Electrical Contractors Association



## THE Trouble-Free Worksaver PIPE WRENCH

**RIGID** is guaranteed  
against wrench housing  
repairs or expense



●What's that guarantee mean to you? That when you use **RIGID**s, you're practically free of wrench repair bother and expense, as millions of users know. Some day when you replace those positive-action jaws, the housing will be true as ever, adjusting nut will still spin easily to pipe or conduit size. With that handy pipe scale on hookjaw and comfort-grip I-beam handle you do more work with less effort with **RIGID**. Buy at your Supply House.



End pattern for  
pipe  
in coils.

## THE Easier Threading POSTER DIE STOCK



**RIGID No. 1R**  
gives you the popular time-  
saving plate-type workholder

●Prefer a poster-threader? Here's the one that's ready to thread 1" to 2" pipe quickest, with least fuss—**RIGID** No. 1R. Dies change as fast as any but the mistake-proof workholder sets to pipe size in a jiffy—no bushings to monkey with—only 1 screw to tighten on pipe or conduit. You'll like the direct threading action—no wobble. Long life steel-and-malleable construction. Popular price—ask your Supply House.



Stands up hand-  
ily anywhere.

# RIGID

**WORK-SAVER PIPE TOOLS**  
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"Jagabi" Hand Tachoscope  
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Tachometer. Bulletin 1795-EC.



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"Jagabi" Speed Indicator  
Bulletin 1815-EC.



Over the past 30 years the Biddle Company has been a source for precision speed measuring instruments that have consistently demonstrated superior quality, high accuracy and dependability in service. Carried in stock are a variety of types and ranges of instruments for measuring rotational and surface speeds, rates of vibration and speeds of totally enclosed machines . . . helpful in the solution of your engineering problems. We shall be pleased to quote on your needs. Send for literature today.

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Bulletin 1710-EC.



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ELECTRICAL & SCIENTIFIC INSTRUMENTS  
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held in New Orleans March 13-15, with discussions of "force account" work and "labor only" contracts featuring a majority of the sessions which were addressed by government representatives and officers of the association.

At the close of the meeting W. P. Cagney, Jr., Contracting and Materials Company, Chicago, Ill., was re-elected president of the RECA. Other officers named include R. N. Campsey, R. N. Campsey Construction Company, Denver, Colo., vice-president; Roy Richards, Roy Richards Construction Company, Carrollton, Ga., vice-president; S. O. Sarkness, Sarkness Construction Company, Fargo, N. D., treasurer; Paul C. Wallack, Walco Engineering and Construction Company, Tulsa, Okla., secretary; and J. W. Foster, New York, executive secretary.

Highlight of the convention was an address by J. K. O'Shaughnessy, chief of REA's engineering division, at the closing session in which he pointed out that REA itself would like to see all of the work done on labor and material contracts, rather than on "labor only" contracts.

He pointed out that Engineering Memorandum 170 was issued only as an expedient when it was proved that contractors were not able to get the equipment needed to do the jobs. "About 50 percent of the labor and material contracts still left are not completed and they are not completed because the contractors are not getting the materials," he asserted. "What has happened to this skill in being able to get materials that you contractors have been talking about?" he asked.

"Engineering Memorandum 170, I might tell you, was originally written in the engineering division, but got a mean going over in the office of the administrator as do all orders affecting policy. I personally re-wrote it several times before it was accepted and I think it represents the best thinking of many in REA," Mr. O'Shaughnessy stated in answer to the many criticisms of the memorandum expressed at the meeting.

He added "we are getting better labor bids under 170 than we were getting under labor and material contracts because the contractors will get on a job, do it, and get out. It will not work 100 percent, we did not expect it to, but it will work most of the time."

In commenting on the "disturbed state" of contractors over the "force account" work, the Washington official said "last year was the biggest year of force account construction. 25,000



# AUSTIN REEL ROLLER

(Patent Pending)

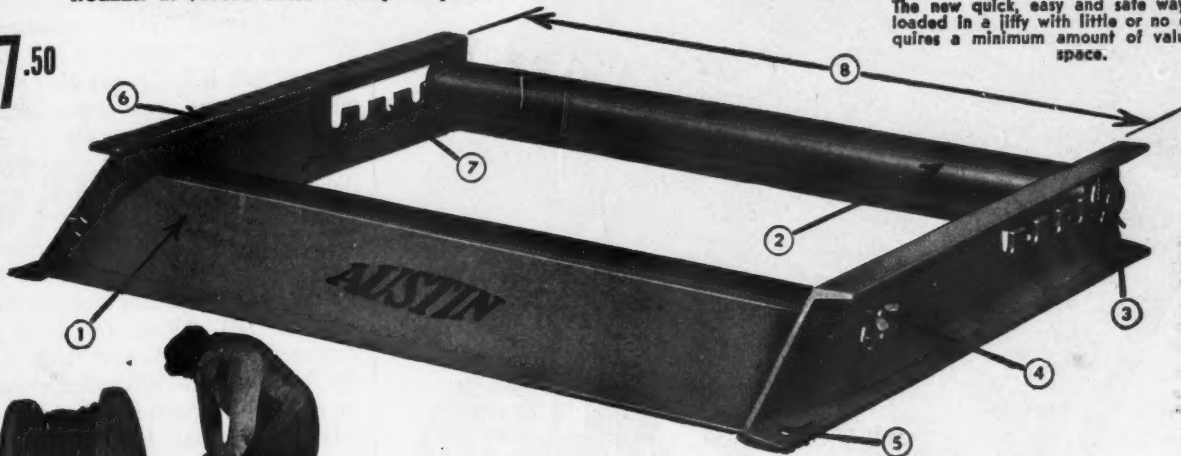
## NEW, SIMPLE, QUICK, SAFE METHOD

The AUSTIN Reel Roller dispenses any material that is wound on a reel and every Electrical Contractor, Utility, REA Co-operative, Shipyard, Railroad, and Wholesaler needs them. Mounted stationary or can be used on job as a portable device—Ideal for pulling one or more cables into conduit and for service and repair trucks. A most economical investment . . . No. 600 REEL ROLLER at \$37.50 each. Prompt Shipment.



The new quick, easy and safe way. Reel is loaded in a jiffy with little or no effort. Requires a minimum amount of valuable floor space.

\$37.50

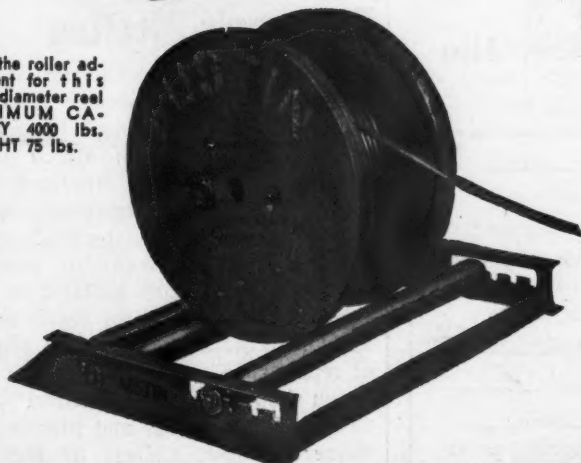


The old way—laborious, unsafe and costly.



THE AUSTIN REEL ROLLER makes this an easy one man job.

Note the roller adjustment for this small diameter reel  
MAXIMUM CAPACITY 4000 lbs.  
WEIGHT 75 lbs.



## POINTS THAT MAKE THE AUSTIN REEL ROLLER OUTSTANDING

- (1) Ramp—Makes it quick and easy to load the reel onto the rollers.
- (2) Back roller is mounted slightly higher, preventing the reel from being pulled off the roller when cable is removed.
- (3) Reel rolls on grease packed flanged ball bearings with the greatest of ease and safety.
- (4) Thumb screw, which when tightened, prevents roller from turning for easy removal of reel.
- (5) Hole for lag screw, one in each corner for stationary mounting.
- (6) Heavy steel frame, painted bright orange, not only adds to its appearance, but, also makes it readily visible on the floor which helps to eliminate accidents.
- (7) Five adjustable slots to accommodate various reel diameters. No screws, washers or cotter pins to remove—simply raise up the roller and slide into the slot required.
- (8) Will take any size reel up to 30" in width. For larger reels, use two reel rollers and mount end to end.
- (9) Can be used in the warehouse or on the job.

• ALL AUSTIN Products are sold thru the Electrical Wholesaler exclusively . . .

Send him your order.

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### Every Repairman needs this Handy "On-the-Job" Assortment of Wagner Motor Repair Parts

Be a "One Tripper"—carry this kit in your car for "on-the-job" motor repairs.

It contains fast-moving parts for repulsion-start induction brush-lifting and capacitor-start induction-run motors—up to and including 1/2 hp.

Order for each of your men. Use coupon below. Also available at 325 authorized service stations.

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Gentlemen:

Please ship \_\_\_\_\_ Motor Parts Assortment M-1 at \$10.53 each (Net) total  
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☐ Also send copy  
of Motor Parts  
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M47-13

**Wagner**  **Electric**

miles of line was built by force account construction and this year about 8000 have been built so far and a total of 15,000 or 16,000 is now indicated for the present year."

Claude Wickard, Administrator of REA, was represented by Carl Hamilton, assistant administrator, whose address was entitled "The Past, Present and Future of REA."

He pointed out that up to the end of the war REA had built about 425,000 miles of line and people were no longer "just wanting electricity," they were clamoring for it as compared to the early days "when you had to get out and sell it." It was also pointed out that in the two years since the war Congress has made available \$550,000,000, more than was available during the first 10 years of the program.

In his annual report, Paul Wallack, secretary of RECA, scored the REA action in adopting Engineering Memorandum 170 calling for labor only contracts. "We do not think it was the best way to solve the problem," he asserted. "As it is being done on a labor only basis," he said, "the cooperative does not have the benefit of the contractor's skill and training in the purchasing of materials. The argument that the contractors would be building up a backlog, charging high prices, and diverting the materials into other channels is a very weak argument. The whole REA program would be helped and more lines built if 170 was rescinded."

Other speakers at the three day meeting were Joseph F. Marion, representing the REA finance office; and Hugh Owensby, REA legal advisor. The sessions were presided over by Cagney.

### NISA N. E. Chapter Foreman's Meeting

The New England Chapter of the National Industrial Service Association, Inc., held its annual Foreman's meeting in Boston on March 15th. Meeting at the Hotel Bradford, 140 members and guests registered, representing 35 of the Chapter's 52 member firms and two Associate member firms. The program included an inspection tour to a motor repair shop, a number of talks on various phases of repair shop activities, a contest between shop foremen on practical "how to do" shop methods and practises, a dinner banquet, address by the national president of NISA, entertainment, and award of prizes to foremen who entered the contest.



# ECONOMY DE-LAY

Renewable Cartridge Fuses

SUPERIOR PROTECTION

...where time delay is needed **MOST**

See your  
Electrical Wholesaler  
for the new Economy  
Time-Delay Fuses and Links;  
he has them in stock.

SEND FOR NEW CATALOG

Most electric circuit "blows" come on overload operation (rather than on "shorts" and "grounds")—and most overloads are within the 135 and 200% range.

Economy Time-Delay Renewal Links are specifically designed to meet the above requirements; to give superior protection in these very ranges where time delay is most needed, i.e. 135 and 200% overloads.

Mechanically simple—It takes only a few moments to restore blown fuses to their original efficiency. Fully meet the requirements of the "Standard for Fuses".

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Representatives in all Principal Cities.

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# Collyer

## WIRES & CABLES

**COLLYER Wires and Cables speed up installation, outdoors or in... they offer every quality for easy working and maximum service.**



### SERVICE ENTRANCE CABLE



COLLYER Service Entrance Cable, Type SE, Style U, unarmored, with concentrically wound bare neutral, eliminates conduit and is tamper-proof.

- ★ Flexible and lightweight.
- ★ Neat and inconspicuous.
- ★ Gray, flame-retardant, weather-proof braid.



### CABLEX (Non-metallic sheathed cable)



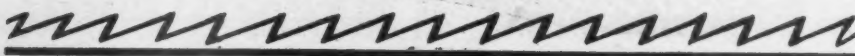
COLLYER Cablex Non-Metallic Sheathed Cable, for wiring from meter to outlet, is fast working and uniform. Non-tacky, smooth finish draws through easily. Available in sizes 14 to 4 with 2, 3, or 4 conductors.

- ★ Smaller diameter, lighter weight.
- ★ Collyer Type T Resistol insulated conductors.
- ★ Flame-resistant, rugged braid covering.
- ★ 14/2 and 12/2 in convenient 250 foot cartons.

Let us know your requirements.

**Collyer** INSULATED WIRE COMPANY

245 ROOSEVELT AVE., PAWTUCKET, R. I.



After registration, a group of over 100 NISA members and guests visited the Westinghouse Electric Corporation's Repair Shop in South Boston, where they were conducted on a tour of the shop in small groups. Westinghouse representatives explained shop methods and practices used there in detail. The visitors then returned to the Hotel Bradford, where the afternoon session of the meeting was opened by J. J. Reddington, J. J. Reddington Electric Service Company, Boston, President of the New England Chapter of NISA. He outlined the program for the meeting, complimented the foremen on the record attendance, and introduced the first speaker, Mr. H. T. Lowell, Jr., of the Westinghouse Electric Corp.

Mr. Lowell told the motor repairmen about the Westinghouse "Life Line" motors, giving a complete outline of design, development, use and method of production of these new rugged motors.

R. B. Turner, NISA president, from the Johnson-Turner Electric Repair and Engineering Co., Ltd., Windsor, Ontario, Canada, was next introduced. President Turner complimented the New England Chapter on its activities, and especially on its Foreman's type meeting. He stressed the importance of interchange of ideas, not only among members of the local chapter, but urged their members to writeup their labor-saving ideas and forward them to NISA headquarters, so that other members might also benefit by them.

Edwin E. Kolhoven, Peabody Electric Motor Service, gave a most interesting and technical discussion on the "Fundamentals of Motor Winding." He outlined formulae and short cuts on figuring changes in voltage, speed, frequency and phase, using the blackboard freely to illustrate examples.

Chapter President Reddington next introduced Fred S. Ferris, Boston, and turned over the chairmanship of the meeting to him. Mr. Ferris introduced Hector W. Munro, New England Machine and Electric Co., Pawtucket, R. I., who in turn introduced the seven shop foremen that had entered the Foreman's contest on "How to Do It Quicker, Cheaper and Easier." Each of these shop foremen presented a "how to do" idea, some by discussion only, others by charts or sample units, and others by blackboard diagrams. A committee of judges had been set up to award prizes for these ideas. The award of prizes was held for announcement during the evening session.

President J. J. Reddington officiated during the banquet and evening ses-



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*For manufacturing, domestic,  
industrial and utilities  
wiring . . .*

## **Specify wire and cable insulation made from GEON Plastics**

- 8 REASONS WHY . . .**
- ★ ***Excellent electrical properties***
  - ★ ***Thin coating of insulation***
  - ★ ***More conductors in a given space***
  - ★ ***Ease of handling***
  - ★ ***Easy stripping***
  - ★ ***Light weight***
  - ★ ***Resistance to ozone, wear, sunlight,  
water, chemicals, and most other  
normally destructive factors***
  - ★ ***14 colors including NEMA standards***



Be sure to specify wire or cable insulated with GEON in order to get *all* these advantages. Or, for information regarding special applications please write Department H-4, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

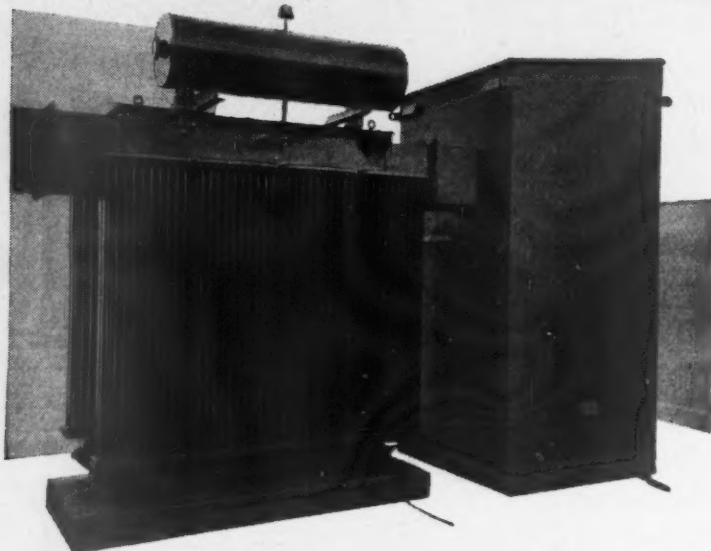
### **B. F. Goodrich Chemical Company**

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ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . APRIL, 1947

# DAVIS TRANSFORMERS



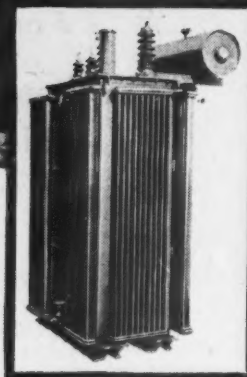
2000 KVA. OISC. 60 CYCLES. THREE PHASE 13800-480. 10% TAP RANGE. THROAT CONNECTED TO SWITCH GEAR ON HIGH VOLTAGE SIDE AND BUS RUN ON LOW VOLTAGE SIDE.

## Power Transformers



### POWER TRANSFORMERS FOR MIDWEST R. E. A.

750 KVA. OISC. SINGLE PHASE 60 CYCLE.  
33,000/23,000-7200 WITH 4 - 2½% TAPS.



**DAVIS  
TRANSFORMER CO.**

Phone 177 CONCORD, N. H.

MANUFACTURERS OF OIL COOLED, DRY TYPE,  
POWER AND DISTRIBUTION TRANSFORMERS



sion. He gave a short address of welcome, and introduced the officers and committeemen who had so ably assisted in arranging this meeting. He introduced Paul L. Keating, Electrical Installation Company, Cambridge, Mass., who spoke on "What Constitutes an Ideal Boss, or an Ideal Foreman." Mr. Keating based this talk on the unsigned returns of a questionnaire mailed out to both groups.

NISA's national president, R. B. Turner, was principal speaker of the evening session. He outlined the aims and objectives of the national group, and ways of cooperating so that the greatest number of members will benefit from the experiences of other members.

George W. Williams, Superior Electric Company, Springfield, Mass., wound up the evening session with the announcement of prize winners in the Foremen's contest. These winners were: *First Prize*—LeRoy E. Whitaker, Electrical Installation Co., Cambridge, Mass. *Second Prize*—D. E. Nickerson, Central Electric Co., Cambridge, Mass. *Third Prize*—Eric Gyllenberg, Electrical Installation Company, Cambridge, Mass. *Other Prize Winners*—Hector W. Munro, N. E. Machine & Electric Co., Pawtucket, R. I.; R. Bruce Burns, Electric Motor Service & Repair Co., Fitchburg, Mass.; J. C. Calhoun, Empire Electric Co., Cambridge, Mass.; Tracey Electric Company, Concord, N. H.

## Wiring Device Requirements

Overall 1947 requirements for critical electrical wiring devices were outlined by Civilian Production Administration officials at a meeting of the Electrical Current-Carrying Wiring Devices Industry Advisory Committee.

The requirements, which are chiefly related to housing, include those of the Veterans' Emergency Housing Program, rural electrification, repair and maintenance of wiring in existing housing, and essential commercial and industrial construction.

The total national requirements for 1947 are:

For toggle switches, 64.1 million; convenience outlets (receptacles), 66.1 million; medium screw base sockets, lampholders and lamp receptacles, 141.2 million. Requirements for wall plates will match those for toggle switches and convenience outlets. The total requirement figures do not include deficits accumulated in 1946 of approximately 9.3 million toggle



# No more loose connections!

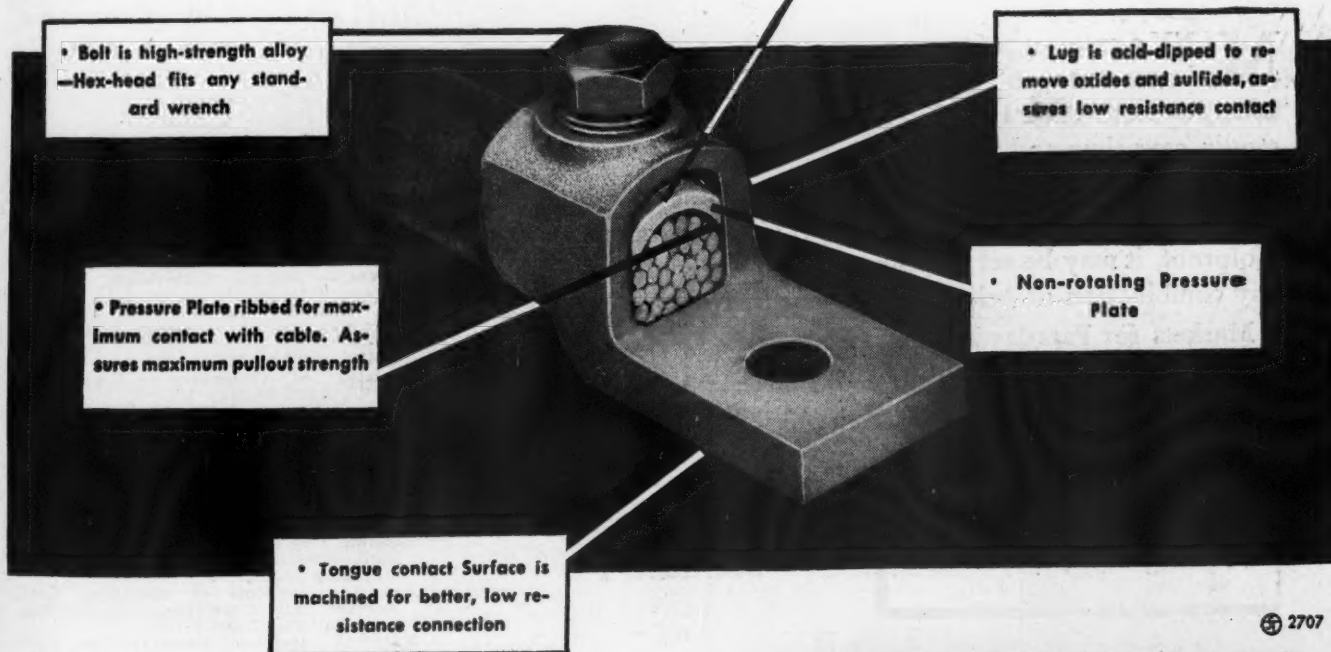


**O.Z.** has **this** spring steel lock washer **here**



Only O. Z. has a tin plated Spring Steel Lock Washer in a solderless connector lug! Only O. Z. Connector Lugs can give you such positive insurance against the hazards of loose connections! Superior to washers of "special" alloys, the O. Z. Spring Steel Lock Washer holds its resiliency, exerts greater locking pressure and *maintains* that pressure. Once tight, always tight—if it's O. Z.

**O. Z. Solderless Connectors** set a standard of superior design. Check these *Additional Features!*



Ⓢ 2707

**"They're O. K. if they're O. Z."**

**CONDUIT FITTINGS • CABLE TERMINATORS  
CAST IRON BOXES • SOLDERLESS CONNECTORS  
GROUNDING DEVICES • POWER CONNECTORS**



Your customer "Gets his man"  
with  
**FARADAY KODEMASTER**



**M**ANY a customer of yours wastes precious minutes tracing the man he wants from place to place through his switch-board operator. Faraday Kodemaster would signal him *instantly*, save time and money.

Kodemaster is the ideal control for locating individuals; and includes up to 30 code signals. Unique, compact and foolproof, it may be set up with *new or old* signal systems in any combination of bells, buzzers, horns, Kodaires, chimes.

Markets for Faraday Kodemaster in your area are practically unlimited . . . and so are the profits you can make by recommending and installing it. Investigate today!

Faraday Unipact signal units are interchangeable, "as easy as plugging in a toaster."

*At your electrical distributor's*

**FARADAY**  
**ELECTRIC CORPORATION**  
ADRIAN, MICHIGAN

switches and 14.8 million convenience outlets.

The committee agreed that these requirements could be met if sufficient phenolic resin molding compound is made available. The supply of all other materials will be good this year.

The committee expressed the unanimous view that every effort should be made to dispense with Schedule 121 to the chemicals order, M-300, or any other allocation technique relating to the distribution of phenolic molding compounds for wiring devices. It recommended that the distribution of these compounds for the rest of 1947 be left to the molding compound producers. However, the committee said, there should be an agreement on the part of these producers to supply the wiring device industry with sufficient compound to produce enough critical wiring devices to meet national requirements.

Albert A. Fox, chief of the CPA Electrical Products Branch, Building Materials Division, was government presiding officer at the meeting.

## N.M. Contractors Elect Officers

L. W. Irick, Gallup, has been elected president of the Associated Electrical Contractors of New Mexico. Other officers: L. H. Chant, Albuquerque, vice president; Mrs. Frances Connolly, Deming, secretary; John Yearout, Albuquerque, treasurer.

## DATES AHEAD

National Association of Corrosion Engineers — Annual Convention, Palmer House, Chicago, Ill., April 7-10.  
Home Builders Council of N. Y., N. J. and Connecticut — A Metropolitan Home Show, Grand Central Palace, New York, N. Y., April 19-27.  
Chamber of Commerce — Washington, D. C., April 28-May 1.  
National Electrical Wholesalers Association — Annual Meeting, Hotel Traymore, Atlantic City, N. J., May 4-8.  
National Plastic Exposition — Colliseum, Chicago, Ill., May 6-10.  
Illuminating Engineering Society — East Central Regional Conference, Washington, D. C., May 15-16.  
National Fire Protection Association — 51st annual meeting, Palmer House, Chicago, Ill., May 26-29.  
American Institute of Electrical Engineers — Summer meeting, Montreal, Quebec, Canada, June 9-13.  
National Electrical Manufacturers Association — Special section meetings, The Homestead, Hot Springs, Va., June 22-26.  
Illuminating Engineering Society — Annual convention, New Orleans, La., September 5-10.  
National Electrical Contractors Association — Annual meeting, San Francisco, Calif., September 8-10.  
International Municipal Signal Association, Inc. — Annual meeting, Pantlind Hotel, Grand Rapids, Mich., September 29-October 2.  
National Safety Congress & Exposition — Chicago, Ill., October 6-10.  
National Electrical Manufacturers Association — Traymore Hotel, Atlantic City, N. J., Week of October 27.



Electrical equipment is no better than its insulation

## TO INSULATE Diesel Electric Drives

The 75,000th locomotive produced by the American Locomotive Company is powered by a diesel-electric drive built and insulated by General Electric.

and for Every Insulation Need

THERE'S A  
G-E INSULATING  
VARNISH THAT IS  
RIGHT FOR THE JOB

● For production, maintenance, or repair of electrical equipment, use G-E Insulating Varnishes. Consult General Electric, too, for superior finishing and sticking varnishes.

General Electric's expert technical service benefits from 46 years of varnish research and manufacture. Strict G-E Quality Control of every step in the manufacturing process assures uniformity of product month after month.

With its huge productive capacity, General Electric can now supply all these varnishes in quantity. Call your local General Electric Mer-

chandise Distributor for details. Or write direct to Section RIMA-475, Resin and Insulation Materials Division, Chemical Department, General Electric Company, Schenectady 5, N. Y.

FOR INSULATING • FINISHING • STICKING

Order



# GENERAL ELECTRIC

CD4T-JB

G. E. OFFERS A COMPLETE LINE OF INSULATING MATERIALS

FULLMAN

# Latrobe PRODUCTS

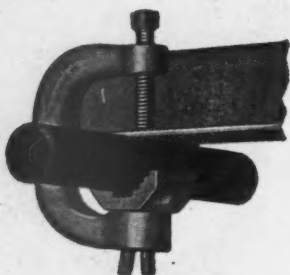
FLOOR BOXES

WIRING SPECIALTIES



**Because of High Performance  
These Items Rate High Preference**

Latrobe Products are quick sellers. There are no "shelf warmers" among them to tie up your capital and cut into your profits. They move off the shelf because they stay put on the job—and that makes everybody happy.



**No. 470 "Latrobe"  
Pipe or Conduit Hanger**  
Approved for hanging pipe or conduit 1/2", 3/4" and 1" to steel beams up to 3/4" thick. Can be installed quickly.



**No. 284 Nozzle  
with No. 200 Cover Plate**  
Smart Duplex Receptacle Nozzle. Furnished with 1/2" or 3/4" Brass pipe extension. Neat and practical.



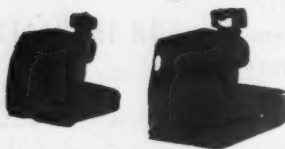
**No. 150 Box  
No. 207 Nozzle**  
Adjustable and watertight for installation in concrete or wood finished concrete floors. Underwriters approved.



**Keystone Fish Wire**  
Made of high quality flat steel wire. Tempered exactly right. Ten sizes.



**"Bull Dog"  
BX Cable Staples**  
These high quality staples are packed in cartons, kegs or barrels.



**"Bull Dog" Insulator  
Supports**  
Clamps of high tensile strength for fastening porcelain or glass insulators to exposed steel framework. Four sizes.

**FULLMAN MANUFACTURING CO.  
LATROBE . . . PENNSYLVANIA**

American Institute of Electrical Engineers  
—Midwest meeting, Chicago, Ill., November 3-7.  
2nd International Lighting Exposition—  
Hotel Stevens, Chicago, Ill., November 3-7.  
National Metal Trades Association—  
Palmer House, Chicago, Ill., November 6-17.  
National Association of Manufacturers—  
Waldorf-Astoria Hotel, New Yrk, N. Y., December 3-5.

## MANUFACTURERS NEWS

### WESTINGHOUSE CHANGES

Robert A. Neal, vice president of the Westinghouse Electric Corporation, has been named general manager of the company's expanding Pacific Coast operations. Westinghouse at present is completing lease arrangements to operate the Sunnyvale, Calif.,



**R. A. NEAL**

plant of the Joshua Hendy Iron Works. Other West Coast Westinghouse plants are located at Los Angeles and Emeryville, Calif., Portland, Ore., and Seattle, Wash.

Gerald Z. Wollam has been named assistant in the supervision of the company's Elevator Division in Jersey City, N. J., and the Sturtevant Division at Hyde Park, Mass.

C. B. Stainback has been appointed industrial syndicate manager, a new position created to better coordinate the industrial sales activities of the company.

### GENERAL ELECTRIC CHANGES

Appointment of Robert W. Ferrell, formerly counsel for the General Electric Electronic Department, Syracuse, N. Y., as manager of Employee and Community Relations of the Affiliated Manufacturing Companies Department of the General Electric Company was announced recently.

George W. Scully has been named wire and cable representative in the Atlantic district.

William P. Barrett has been appointed representative for the conduit products division in Cleveland.

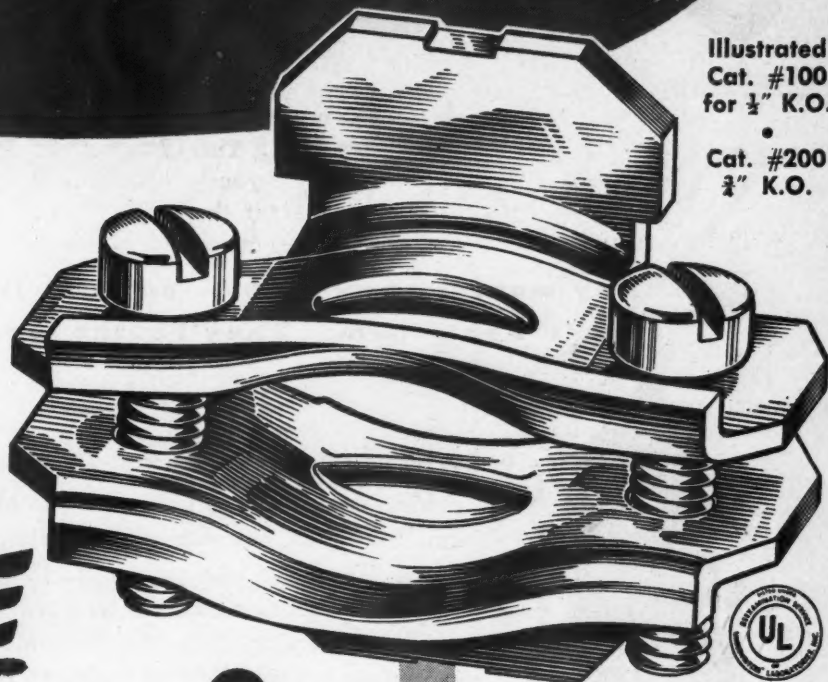


DO LOCKNUTS  
*Handcuff*  
YOU TO THE JOB?

FOR YEARS, installing cable connectors was an awkward, time-consuming job. Troublesome, cumbersome locknuts first had to be unscrewed and then screwed back on from the inside of the box. Lost locknuts meant more lost time and lost money! Today . . . it's just

Illustrated  
Cat. #100  
for  $\frac{1}{2}$ " K.O.

Cat. #200  
 $\frac{3}{4}$ " K.O.



One, Two, Three  
and you're **FREE**

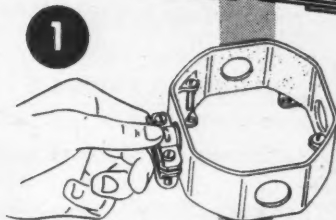
With **TOMIC** non-metallic  
**CABLE CONNECTORS**

Quick and easy it takes just 10 seconds to tip in the connector from the outside — slip in the cable—and flip the screws! No locknuts to lose—no time wasted! So popular, millions have already been sold—so thrifty, their low price saves you money right from the start—so dependable,  $\frac{1}{2}$ " size has passed the Underwriter Laboratory test with the new and old type, non-metallic sheathed cable!

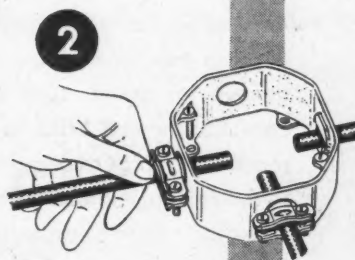
Try 'em once and you'll Buy 'em always! Ask for them by name at your wholesalers!  $\frac{1}{2}$ " and  $\frac{3}{4}$ " K.O. available. If he hasn't got them in stock—contact us direct and give us his name!

**Tomic Sales & Engineering Co.**

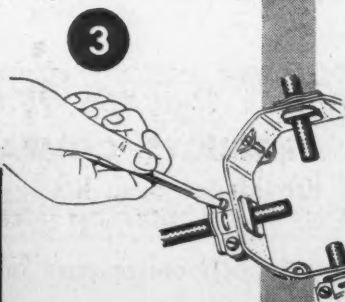
64 Woodward Ave. Detroit 1, Michigan



**TIP** a Tomic cable connector into the hole from outside. Fits in quick and easy!



**SLIP** the cable through! Will handle both new and old type non-metallic, sheathed cable!



**FLIP** the screws on tight—and the job is done right! Exclusive locking feature holds connect or securely!

# Top quality is *Best* at any price

**Pay more . . pay less . . but you just  
can't beat them. They're the best!**



**651-F**  
**FLEX-LOC LAMP HOLDER**  
Listed and Approved by  
Underwriters' Lab., Inc., and  
Canadian Standards Association  
Appliance Division  
E.T.L. Test Report 314454  
Available  
Patented—Other patents pending



**FS-40**  
**AUTOMATIC STARTER**  
Listed and Approved by  
Underwriters' Lab., Inc.  
Certified by E.T.L. Spec. 6  
Pat. Nos. 2200443-2228210

**FLEX-LOC** by Lloyd, is **THE** outstanding achievement in lamp holders . . no other can match its performance! Briefly, the name "Flex-Loc" tells the story. Flexible . . it automatically self-adjusts to variations in length of lamps, or the spacing of mounting holes . . then "click", it locks the lamp securely . . positively! Ingeniously engineered! So simple. So foolproof. So easy to use. Flex-Loc is a **MUST** in the specifications of many lamp manufacturers.

## **HERE'S ANOTHER BEST**

A marvel of modern science. Lloyd's Automatic Starters play a **BIG** part in lighting the lamps of industry. There are millions in use throughout the country! Engineered for quick, sure starting of fluorescent lamps and built to specifications far more rigid than accepted standards . . here is the automatic starter that can't be beat! Results? Saves maintenance costs and power consumption. Protects and insures longer life to ballast and lamp. Eliminates the annoyance of flickering and blinking.

**LLOYD POLICY INSURES QUALITY**

**LLOYD PRODUCTS COMPANY**

Providence 5, R. I.

Branch Offices and Warehouse Stocks in 27 Leading Cities

G. J. Brenner has been named representative of the tungar and metallic rectifier division in the Northwest.

R. C. Sogge has been named manager of Standards Division and Lee F. Adams has been appointed standards consultant. The appointments, Mr. Winne said, will permit Mr. Adams to devote the necessary time to his duties as president of the U. S. National Committee of International Electrotechnical Commission and as vice chairman of the Standards Council of the American Standards Association.

## **BULLDOG ELECTRIC APPOINTMENTS**

Earl S. Guild, former plant engineer at Ranger Aircraft Engines, Farmingdale, L. I., has joined the Bulldog Electric Products Co., Detroit, in the capacity of field engineer. He has been assigned to the Washington D.C. office under M. C. Nelson, to cover the North Carolina portion of the Washington territory.

Bert S. Wardell has joined the Nashville, Tenn. office as a field engineer under District Manager E. R. Boruch, and will make his headquarters in Birmingham, Ala.

## **ALLIS-CHALMERS APPOINTMENTS**

New appointments in the switchgear and control sections and the electronic group of the electrical department of the Allis-Chalmers Mfg. Co. of Milwaukee, Wis., have been announced.

J. S. Morgan is named engineer-in-charge of sales, switchgear and control sections; T. G. A. Sillers is appointed engineer-in-charge of development, switchgear and control sections; C. F. Kucera becomes sales engineer-in-charge of switchgear sales, assuming responsibilities previously handled by Mr. Morgan; and E. J. Rathack is named engineer-in-charge of the electronic group.

## **BRIGHT LIGHT AND INTER- NATIONAL APPLIANCE MERGE**

The Bright Light Reflector Co., Inc., of Bridgeport, Conn. and International Appliance Corp. of New York have been merged and consolidated to form Bridgeport Pressed Steel Corp., with its plants in Bridgeport, Conn. The offices of both the Bridgeport Pressed Steel Corp. and the Bright Light Reflector Co. are located in Bridgeport, and the offices of International Appliance Corp. remain in New York.

Bright Light Reflector Co., Inc. and International Appliance Corp. have been organized as subsidiaries for the new company.

The officers of Bridgeport Pressed





# BRITISH INDUSTRIES FAIR

LONDON & BIRMINGHAM, MAY 5-16, 1947

This is your first opportunity in seven years to see your old suppliers in Britain and to meet new ones.

Overseas Buyers are invited to Britain for the 1947 British Industries Fair. It will enable them to establish personal contact with the makers of the immense range of United Kingdom goods displayed in the London (Lighter Industries) and Birmingham (Hardware & Engineering) Sections of the Fair. The careful grouping of exhibits will assist buyers to compare the products of

competing firms with a minimum of time, trouble and expense. Special arrangements to suit individual markets can be discussed and terms and conditions of business settled direct with the manufacturer, since only the actual producer or the sole selling agent may exhibit.

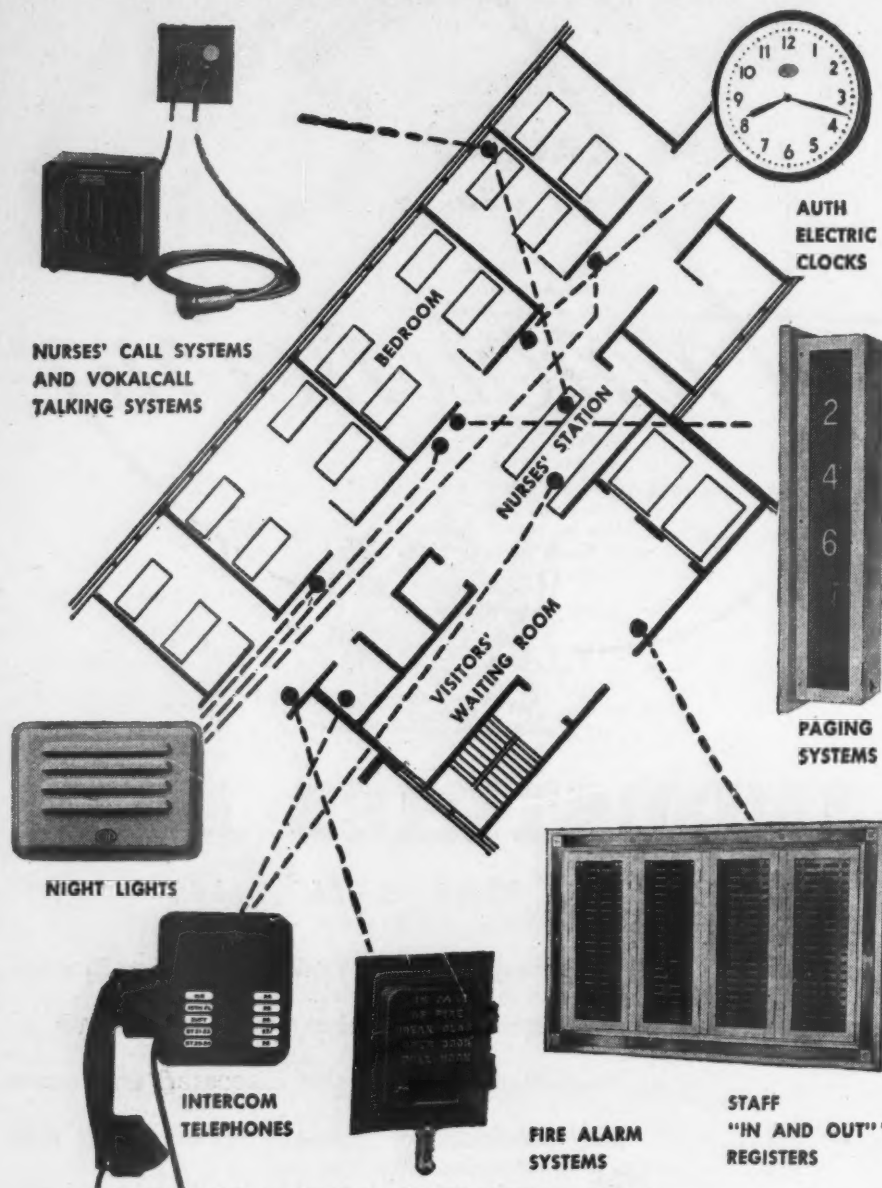
★ For full details of the 1947 Fair apply to the nearest British Commercial Diplomatic Officer or Consular Officer, or the British Trade Commissioner in your area.

**BRITAIN PRODUCES THE GOODS**

ELECTRICAL EQUIPMENT and ACCESSORIES  
will be shown in Birmingham

# AUTH *provides*

## "NERVE SYSTEMS" FOR HOSPITALS



Hundreds of the finest American hospitals depend on Auth systems to provide the rapid contact between patients, nurses, doctors, and staff executives that is so vital to smooth operation.

As pioneers in the manufacture of signaling and communication equipment, Auth has specialized for many years in hospital systems, and offers you a complete line with one responsibility.

Auth engineers are ready to help you plan dependable, modern signaling systems to meet any service and to fit any architectural design.

SEND FOR AUTH HOSPITAL SIGNALING BULLETIN 1-Q

### AUTH ELECTRIC COMPANY, INC.

34-20 45th STREET

LONG ISLAND CITY 1, N. Y.

Offices in



Principal Cities

SINCE 1892

Steel Corp. are Isaac Litner, president; William Litner, vice president and general manager; Leon Litner, secretary and production manager; and Philip Litner, treasurer and sales director. Charles E. School will continue as general sales manager of Bright Light and Monte Closter continues as general manager of International Appliance.

### CUTLER-HAMMER CHANGES

Cutler-Hammer, Inc. have announced the following changes in the company's executive organizational group:

J. C. Springer has been elected treasurer and is also assistant secretary. J. C. Borden has been appointed Comptroller; B. M. Horter director of purchases; Rex Davies manager, credit and collection department; and H. F. Vogt, who has resigned as vice president and treasurer, continues as chairman of the executive committee.

### WESTINGHOUSE SUPPLY APPOINTMENTS

J. H. Stratton has been named appliance manager of the St. Paul branch of the Westinghouse Electric Supply Company.

W. E. Duvall, former apparatus and supplies salesman, was recently named apparatus and supplies manager of the Washington, D. C. branch.

Announcement has been made of the appointment of G. L. Washington as stores manager, Atlanta, of the Company's Southeastern District, succeeding R. A. Bozeman, who has resigned.

Ender Mfg. Corp., New York City has recently appointed two representatives. Irving Shapiro of Philadelphia covers eastern Pennsylvania, Delaware, southern New Jersey and the cities of Washington and Baltimore. Sid Levitt is representative in Ohio, Michigan, Indiana, West Virginia, Kentucky, Missouri and western Pennsylvania.

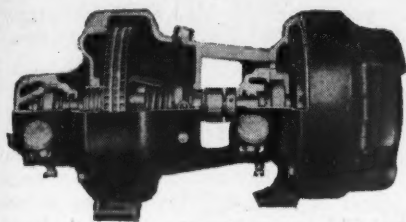
L. C. Joralemon, for many years a field representative for Weston Electrical Instrument Corporation, Newark, N. J., has formed the firm of Joralemon, Craig & Company, with headquarters at 112 South 16th Street, Philadelphia. Mr. Joralemon's partner is D. K. Craig, who has long been associated with him.

They will handle sales of Weston instruments in southern New Jersey, eastern Pennsylvania, the District of Columbia, Fairfax County, Virginia, and in Maryland, with the exception of Allegheny and Garrett Counties.

In addition to representing the Weston Corporation, Joralemon, Craig & Company will also continue to act as



## COMPACT, SELF REGULATING Steam Turbo- Generators



Cross section view K-240  
500 watt turbo-generator

**P**yle-National steam turbo-generators, built in a range of capacities from 500 watts to 12 kw., provide dependable emergency light and power, or auxiliary service anywhere there is a steam supply. These units are compact and easily installed, and are self-regulating, requiring only opening the steam valve to start. They carry full rated load on steam pressures from 125 lbs. to 300 lbs. per sq. in. Fluctuation in load and variations in steam pressure have no appreciable effect upon voltage. Accurate governor action prevents waste of steam under light load.

Turbines—Pyle-National steam turbines also available from 1/4 to 120 hp. for any auxiliary power service. Write for turbo-generator bulletin 4110.

1897 • FIFTIETH ANNIVERSARY • 1947

**THE PYLE-NATIONAL COMPANY**

1344 N. Kostner Avenue, Chicago 51, Illinois



## QUIK-LABELS

Mark your wires Faster

QUIK-LABELS code Wires, Leads, Circuits, Relays, Parts, etc. faster and cheaper. • Pre-cut to exact size, QUIK-LABELS come in rows on handy Cards, stick without moistening. • Replace slow and costly string tags, roll tapes, decals, stencils, metal tabs, etc. • Coated with clear insulating varnish to resist dirt, grease, abrasion. • Removable \*Self-Starter Strip automatically exposes ends of Labels for you to grasp instantly—no more finger-picking. • Cost less to buy-and-apply than all other markers. • Maintenance men carry Cards to the job. • QUIK-LABEL Bench Dispenser holds Cards for production operators to code with both hands free. • 275 NEMA Markings and Colors in stock.

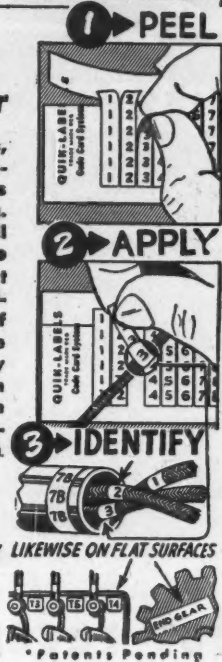
Write for Folder and FREE Sample Cards.

**W. H. BRADY COMPANY**

Mfgs. of Self-Sticking Tape Products

Established 1914

801 N. 3rd St., Milwaukee 3, Wisconsin  
Factory: Chippewa Falls, Wisconsin



BE READY FOR THOSE  
NEW LIGHTING  
JOBS

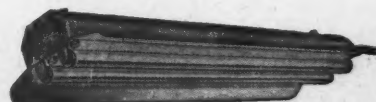


## MULTI INDUSTRIAL LIGHTING EQUIPMENT

• Modernization programs are going to mean modern and newer lighting layouts. MULTI is the line to help you meet all the demands for good lighting in factories, plants, offices, and industries of all kinds. MULTI units are

economical for users and are designed for the specific job. Rely on MULTI for fluorescent or incandescent fixtures—we will supply them promptly.

• Send for our complete catalog •



**MULTI ELECTRICAL MANUFACTURING CO.**

4223 W. Lake Street

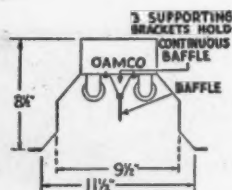
Chicago 24, Illinois



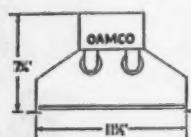
## for recessed mounting

● OAMCO Troffer Fixtures are designed and constructed for general overhead lighting of schools, stores, offices, drafting rooms, and other areas where there is a suspended ceiling.

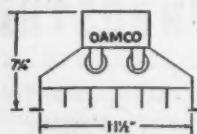
The fixtures are made of heavy gauge steel, finished grey outside, white inside, with a reflection factor of 85%. The flanges on the troffers rest flat against the ceiling. These fixtures are constructed for continuous runs or individual units and are furnished wired including lamp holders, starters and high power factor ballasts.



Open Troffer With or Without Continuous Baffle.



Troffer With Ribbed Glass Bottom.



Troffer With Egg Crate Louver.

RIGHT LIGHT SINCE 1902

**OVERBAGH & AYRES MFG. CO.**

MEMBER OF THE R L M STANDARDS INSTITUTE

411 SOUTH CLINTON STREET • CHICAGO 7

field representative for American Transformer Company, Newark; Weston Electro Mechanical Company, Oakland, Calif., and Radio Frequency Laboratories, Inc., Boonton, N. J.

Marion B. Sawyer has joined Bardco Manufacturing and Sales Company, Los Angeles, where he will be in charge of special motor development and sales. He will retain an affiliation, as a consultant, with Sawyer Electrical Manufacturing Company, which he founded in 1928.

Watco Engineering, Inc. has announced the appointment of Ford Reed as Ohio representative. Mr. Reed's headquarters are at 242 Broadway, Youngstown, Ohio.

Globe Lighting Products Company, New York, has announced the appointment of Morton J. Olschwang as head of Chicago operations. Mr. Olschwang was formerly with the Lightolier Company of Chicago.

Edwards and Company, Norwalk, Conn., announces the appointment of William F. Rooney in charge of merchandise activity. He was formerly with Sylvania Products Company.

E. W. Heffernan has been appointed manager of the Philadelphia sales and service office of Wheelco Instruments Company. His office is at 424 W. Olney Avenue.

Fairbanks, Morse & Co. has announced the appointment of John A. Cuneo as manager of the company's Los Angeles branch, succeeding Harry W. Brown, who has retired.

Ray A. Siedle has been appointed representative for Curtis Lighting, Inc., in the northern New York State territory. He will make his headquarters in Rochester, N. Y.

The appointment of J. H. Wendt as central Pacific district credit manager and T. F. O'Malley as southeastern district credit manager for the Graybar Electric Company has been announced.

Appointment of Henry G. Mahoney as manager of purchasing in the Lighting Fixture Division of Sylvania Electric Products Inc. was announced recently.



## SUPER EXPANSION ANCHORS



The new all steel Super Expansion Anchors are the answer for securely fastening conduit, switches, controls, lighting fixtures, signs and sign supports, etc.

Easy to install,  
will hold securely.

The new all steel S-A Anchors are Cadmium plated for a long life.

The proven expansion of the steel cap has a biting action that really "holds for keeps".

The following sizes in stock for immediate delivery.

10 - 24 3/8 - 16

1/4 - 20 7/16 - 14

5/16 - 18 1/2 - 13

See your jobber or order direct from factory.



The photo shows the actual expansion of the anchor.

**S-A Manufacturing**

11080 Gratiot Ave.

Detroit 5, Michigan

# PARTS

FOR

## FANS MOTORS CONTROLS

PROMPT SHIPMENT FROM LARGE STOCK

AUTHORIZED PARTS DISTRIBUTOR

Brown-Brock-  
meyer  
Century  
Cutler-Hammer  
Delco  
Diehl  
Duro  
Emerson

General Electric  
Hamilton-Beach  
Holtzer-Cabot  
Howell  
Hunter  
Ilg  
Leland  
Marathon

Master  
Peerless  
Robbins & Myers  
Star  
Thor  
Wagner  
Westinghouse

**READING ELECTRIC COMPANY, INC.**

Parts Distributors for the Manufacturer

200 William St.

Barclay 7-6616

New York 8, N. Y.

## IN THE SPOTLIGHT



TOUGH  
CANVAS IMPREGNATED

BAKELITE

WEATHERPROOF

LONGER LIFE

LESS REPLACEMENTS

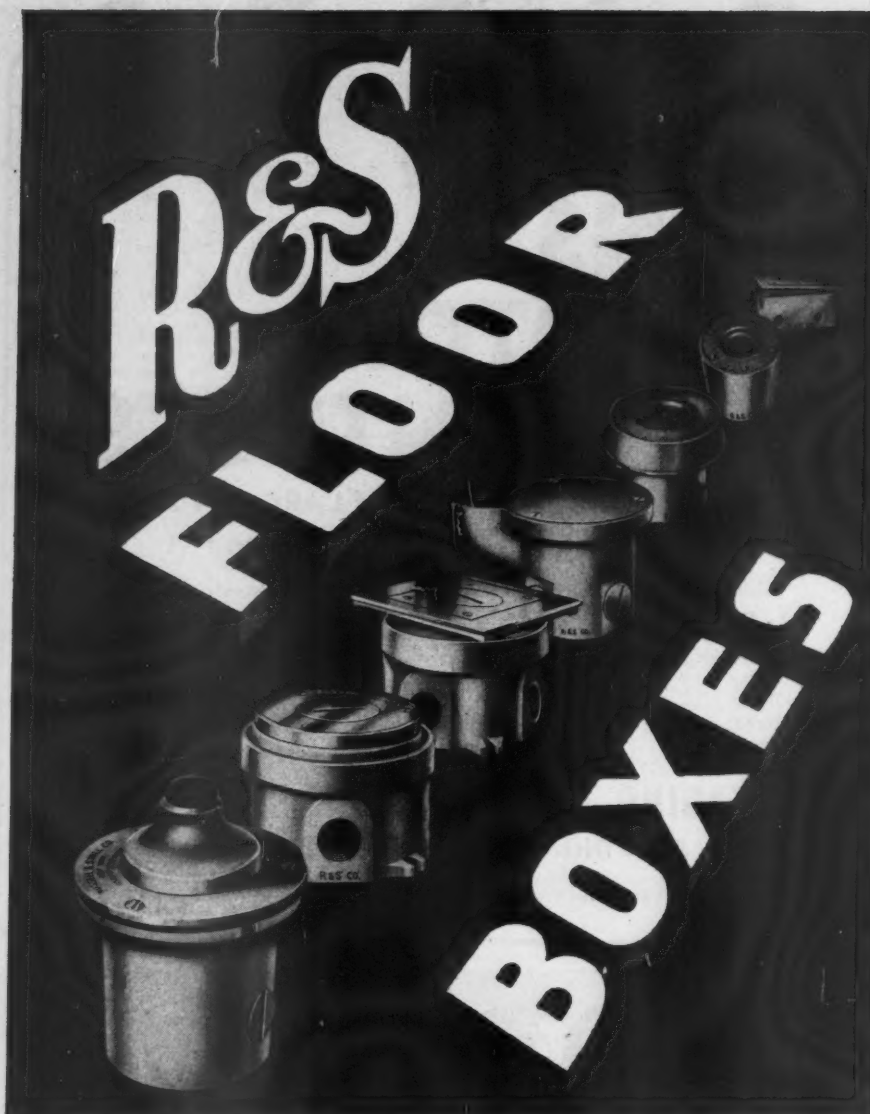
**No. 63310**

Install this socket where toughest conditions prevail. You will then be convinced that you should standardize on the 63310.

*Ask Your Jobber*

**UNION INSULATING CO., INC.**

PARKERSBURG, W. VA.



## AND ACCESSORIES

Better buy R & S Floor Boxes and Accessories because they're a better buy in all ways. Clean-cut design . . . precision, sturdy construction . . . melded phenolic composition interiors . . . compact, with advanced features. They're popular with contractors everywhere because they provide the quickest means for ease in installing and wiring.

The R & S complete line can meet your every need whether for watertight Floor Boxes, single or gang types; Combination Floor Extension Sets, Floor Outlet Type Receptacles, Heavy Duty Floor Receptacles, Plugs, and Accessories.

New Catalog gives complete information on R & S Floor Boxes and Accessories for convenient ordering. Ask for Catalog FB147-4.

**SOLD THROUGH  
ELECTRICAL WHOLESALERS**

Sales Offices in Principal Cities



**RUSSELL & STOLL COMPANY, INC.**

Precision-Built Electrical Equipment

125 BARCLAY STREET, NEW YORK 7, N. Y.

The Mitchell Manufacturing Company, Chicago, has announced the appointment of Fred Masterson as assistant sales manager.

Charles M. Brown has been appointed sales manager of the American Coach & Body Company, Oakland, Calif.

Ward Leonard Electric Co., Mount Vernon, N. Y., announces the appointment of Southern Sales Co., 1135 Lincoln Tower, Fort Wayne, Ind. as its industrial representative in Indiana and western Kentucky.

Jefferson Electric Company has purchased the plant at Fall River, Mass., which was used during the war by the Submarine Signal Corporation. Executive and administrative offices will remain in Bellwood, Ill.

Fairbanks, Morse & Co. has announced the appointment of John S. Kind as manager of the Chicago branch, succeeding Frank V. Roy who retired from that position on March 1.

Hexacon Electric Company, of Roselle Park, N. J. announces completion of the new addition to the factory. The general offices will continue to be located at 191 West Clay Avenue, Roselle Park, N. J.

The Doall Company and the Doall International Company have moved into new quarters at 254 North Laurel Avenue, Des Plaines, Ill.

Leo L. Helterline, Jr., has been appointed chief engineer for Sorenson & Company, Inc., Stamford, Conn. He will be responsible for the design and development of all Sorenson products.

Appointment of Francis J. Wakem as vice president of Johns-Manville Sales Corporation has been announced. Mr. Wakem will also continue as merchandise manager of the industrial products division.

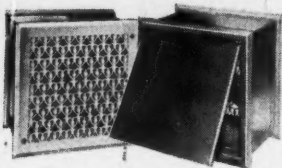
Lasser Mfg. Company has acquired a new plant in Miami, Fla. The general offices will be located in the building at 40 N. E. 22nd Street.

R. T. Bennett has joined the Tru-Air Ultraviolet Products Company of Los Angeles, a subsidiary of Mitchell Manufacturing Company, as germicidal specialist and representative in the New England states.

The Griswold Manufacturing Company of Erie, Pa. has been transferred to new ownership. I. Tachna will be president and general manager of the company. The policy of the new management will be to maintain the same operating and sales personnel.



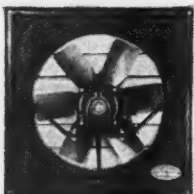
**LOOKING FOR  
FANS  
THAT ARE...  
EASY TO SELL**



#### BUILT IN TYPE KITCHEN FAN

Quiet, powerful, dependable operation! Simple to use. Pull chain starts and stops fan, opens and closes outside door. Adjustable to wall thickness. Smart, interior grill.

#### EFFICIENT



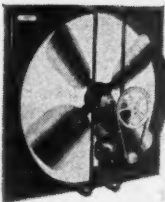
#### 6 BLADE EXHAUST FAN

For offices, factories, stores, etc. Heavy duty fan with shutters attached. Resilient mounted sleeve bearing motor. Heavy gauge steel used throughout.

#### ECONOMICAL

#### BELT DRIVEN EXHAUST FAN

Economical air conditioning for commercial, industrial and attic purposes. Of heavy gauge steel with heavy duty standard make motor. Built and priced to sell.



#### BERNS AIR KING

SOLD EXCLUSIVELY THROUGH LEADING ELECTRICAL WHOLESALERS

**BERNS AIR KING**  
EXHAUST FANS • AIR CIRCULATORS  
BLOWERS • BELT DRIVEN FANS

**BERNS MFG. CORP.**

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Formerly Berns Specialty Mfg. Co.



## CUT DAYS OFF WIRING JOBS...

### WITH THE KETT TALL REACH WOOD BORER

BORES THROUGH WOOD, STEEL AND MASONRY! NOW—DOES FIVE DAY HAND BORING JOB IN LESS THAN A DAY.

• The KETT Model KU-21 "Tall Reach" Wood Borer solves every boring problem for electrician, maintenance man, plumbers, and others. No more ladder-climbing... no more crooked holes. On its light, sturdy extension, it reaches up 10 feet above the floor. Removed from the extension in seconds, it's a versatile hand tool, reaching into "impossible corners".

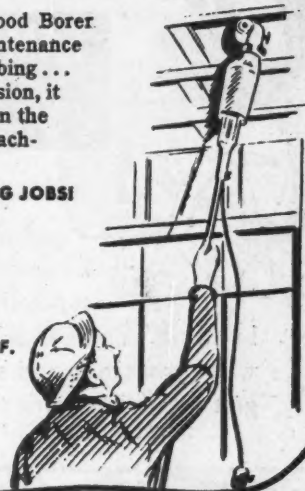
#### PAYS FOR ITSELF ON THE FIRST FEW HOUSE WIRING JOBS!

The KETT "Tall Reach" Wood Borer is the "on-the-job" tool, saving time and money... saves worker fatigue and accidents. Customary wood, metal and masonry bits available in 11/16", 12/16", and 16/16" sizes.

See your distributor for demonstration or write for Bulletin F.

*The KETT Tool Company*

5 EAST THIRD STREET  
CINCINNATI 2, OHIO



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## LIGHTING UNITS for SERVICE STATIONS

FLOODLIGHTS  
FOR AREA LIGHTING

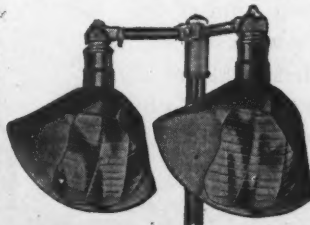
ANGLE REFLECTORS  
FOR THE SIGNS

**We can supply  
any unit your  
customers  
require**



**MAKE** those service stations not only attractive, but scientifically illuminated with QUAD UNITS. Our most complete line gives you the right types of lighting units regardless of station layout. So that you may be fully informed send now for our catalog.

Sold through Electrical Wholesalers.



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# PLUG-IN

for a BIG fan year

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*Emerson-Electric*

**FAMED FOR QUALITY  
for 57 Years**


There's a world of sales power in Emerson-Electric's 57-year reputation for quality fan building. You plug-in for your share when you stock and sell America's biggest values in electric fans.




**II**

*America's  
BEST ADVERTISED  
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More than forty leading publications now carry the Emerson-Electric story to 59 million prospective fan customers! Here's selling power to pull more and more buyers to your store.



**Backed by Practical  
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Eye-catching window and counter displays, sales-building newspaper ads, attractive hand-out leaflets...they're all yours for a BIG fan year when you plug-in to Emerson-Electric's practical sales and merchandising program.

Write for Your 1947 Fan Catalog No. 309

16

**EMERSON ELECTRIC**

MOTORS · FANS · APPLIANCES

THE EMERSON ELECTRIC MFG. CO. • ST. LOUIS 21, MO.



## PUBLIC ADDRESS SYSTEM INSTALLATION [FROM PAGE 17]

for voice reproduction to a complicated voice and music distribution system for complete amusement parks.

Permanently installed amusement systems require special engineering. This consists of a survey by the installation engineer who takes into consideration the type of program desired to be reinforced, the areas to be covered, and the type of acoustics encountered. He then determines the location of the control equipment for the system and the possible locations of the speakers. The ambient noise levels, such as adjoining areas, street car lines, and other noise producing devices, are also taken into consideration. This information is then presented along with sketches or blueprints of the area to the project engineer, who estimates the requirements and presents a block diagram of the proposed system showing the type and amount of equipment, wiring, and conduit required for the installation. If this meets with the approval of the customer, more complete information is prepared by the project engineer, in the form of wiring diagrams and inter-connecting information. Usually included in the total cost of the installation, is the service of a supervising engineer, who follows the job through, spending considerable time on the job filling in the details required during the installation, and performing the final tests and assuring the customer of a satisfactory installation.

### Stadiums, Arenas

Public stadiums, such as football fields, boxing arenas, ball parks, may be serviced from a standard packaged unit that supplies the necessary microphones, amplifiers and speakers which can only be determined by a survey of the area to be covered. The electrical contractor, in these standardized installations, provides two types of wiring to complete the installation. First, the microphone line between the microphone and the power equipment, and second, No. 14 rubber covered wire between the amplifier and the speakers. At least thin wall conduit is recommended but it is not necessary if all the lines have mechanical protection. Caution should be observed to use a lead covered wire any time the installation goes below the ground level of the buildings.



FOR  
**BETTER  
MOTOR  
BRUSHES**

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INFORMATIVE  
CATALOGS and  
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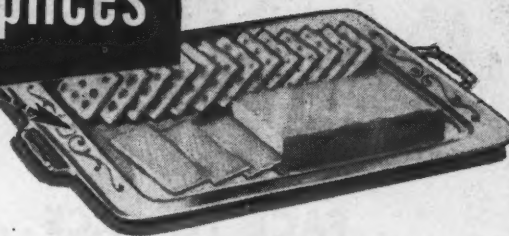
FOR THE  
ANSWER TO YOUR  
MOTOR BRUSH  
PROBLEMS

Call **OHIO**

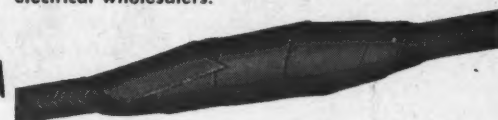
**THE OHIO CARBON  
COMPANY**

12508 BEREA ROAD  
CLEVELAND 11, OHIO

famous splices



**CHEESE and CRACKERS**... What a team! Permanent partners like wire ends joined in a **SUPER-STIK** splice. Distributed only by authorized electrical wholesalers.



**Super-stik**

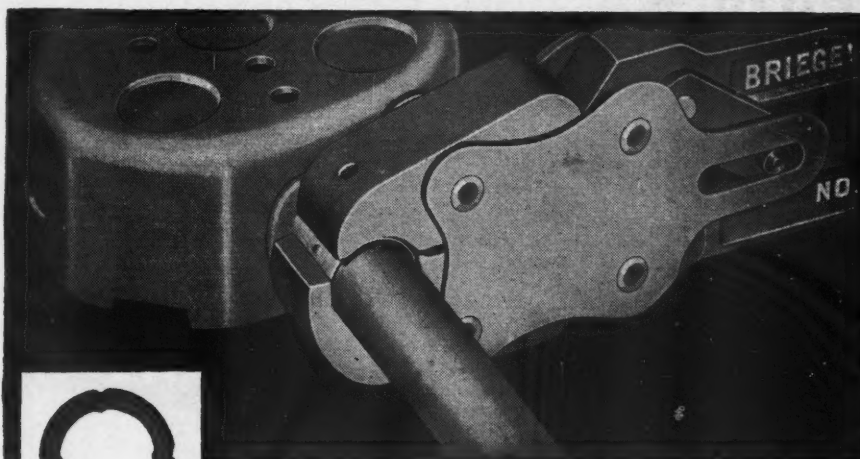
**FRICITION TAPE**

"Sticks to the End"

SUPERIOR INSULATING TAPE COMPANY

ST. LOUIS, MO., U. S. A.

Established 1923



Cross section Showing Indentations.

**E·M·T·UP THE QUICK WAY**  
**Two Squeezes and it's Set**



**TWO QUICK SQUEEZES** give you Finer, Faster Conduit Connections. B-M Fittings do away with the twisting, turning and tightening of nuts and save you valuable time and materials. Then too, they are stronger, neater and much easier to work with in tight places. Start using B-M Fittings today. Have more satisfied customers—more profits from each job!

(All B-M Fittings carry the Underwriters Seal of Approval)

**DISTRIBUTED BY**

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**BRIEGEL METHOD TOOL CO. • Galva, Ill.**

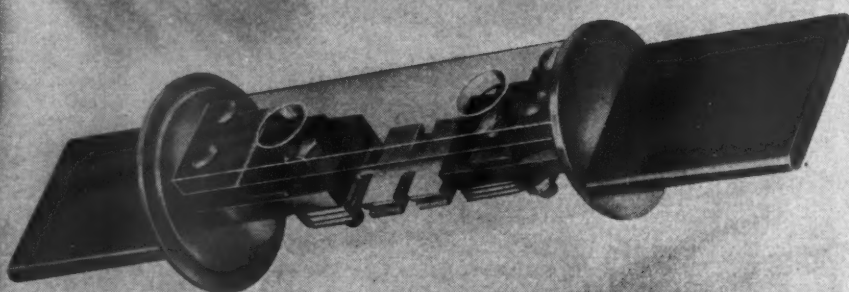
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FACE TO FACE....

*You are Impressed with the Amount of*

**BRASS**



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AS WELL AS...



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**Monarch Renewable Fuses**

are famous for

**BETTER HEAT DISSIPATION**

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AVAILABLE THROUGH RECOGNIZED WHOLESALERS

**MONARCH FUSE CO., LTD.**

118 E. F. ST. ST.

JAMESTOWN, N. Y.

## INDUSTRIAL LIGHTING

### TECHNIQUES

[FROM PAGE 62]

pressed air system which keeps dangerous and explosive vapors out of the unit.

The new circular fluorescent lamps can be installed on certain types of machines so that they encircle the working parts and direct well diffused light over the work area, or object to be seen.

Assembly lines and work benches can be efficiently lighted with standard units properly located with respect to the work areas, or by specially designed units having asymmetric light distribution. Units should be properly located so that direct light from the unit is shielded from the eyes of the workers, or the units should be equipped with louvers to provide the necessary shielding.

**Color Quality.** Fluorescent lamps are made in four degrees of "white", as distinguished from colored lamps. These are commonly referred to as soft white, 3500-degree white, the new 4500-degree white, and daylight.

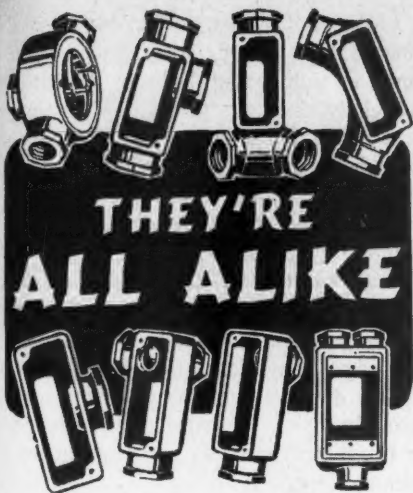
Soft white lamps are pinkish in color, and not generally used in industry. They are suitable primarily for use in food processing plants where workers are inspecting and grading foods, especially meats.

The 3500-degree white lamps are now the popular type for industrial lighting. They produce a white light comparable with sunlight one hour after sunrise, or with high wattage (1000—1500 watt) incandescent lamps. They are deficient in orange and red radiation, hence have a "cool" appearance.

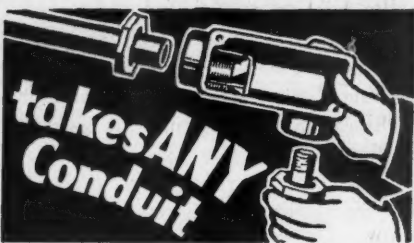
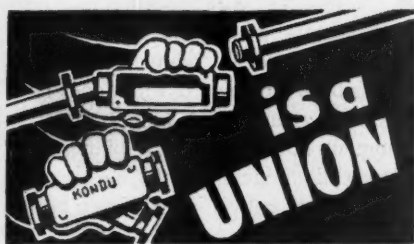
The new 4500-degree white lamps, developed during the war, are destined to become popular, and it is believed will replace to considerable extent the 3500-degree white lamps in industry. This light approaches the color of average noon sunlight, is whiter than light from high wattage general service incandescent lamps, and is in the range of light produced by filament photographic lamps which operate at high efficiency and short life. This color of light blends well with daylight.

The daylight lamps produce a light comparable in color to daylight on an overcast day. Their designation is 6500-degrees, and they are suitable for use in metal working plants processing bright and gray metals, or areas requiring an approximate daylight color quality of light.



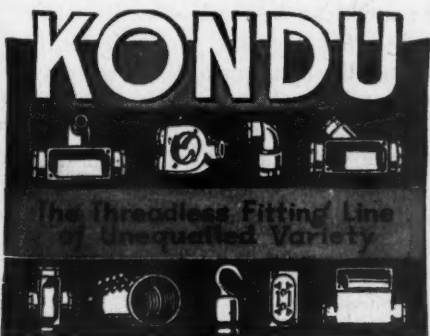


in 2 Important Ways!  
Every KONDU Fitting



Only with Kondu can you take one fitting out of the line and put in another, without disturbing conduit . . . or put up conduit before the fittings are delivered. Only with Kondu can you use either standard conduit or thin-wall, at any outlet. Kondu fittings are vibration-proof. Practically unbreakable . . . 100% re-usable. Write for the Kondu Catalog.

KONDU CORPORATION, Erie, Pa.  
KONDU MFG. CO. LTD., Preston, Ontario



Just connect wires, screw to outlet box and your chain suspension fixture is hung—in a few minutes. All it takes is a screwdriver!

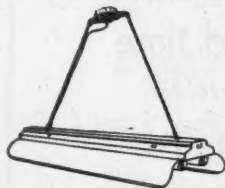
Complete with receptacle, two 5-foot chains, "S" hooks and cord clips. Fits standard 4" or 3 1/4" outlet box or plaster ring. Self-grounding—regular 2-wire cord and plug may be used.

\$1.65 each list

Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis 7, Mo. Nationally distributed through leading electrical supply houses.

In Canada: address all inquiries to Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

\*Patent No. D-141024, others pending. Underwriters approved.



IT'S EASY TO SEE WHEN IT'S

**DAY-BRITE**  
*Lighting*



Fast, Efficient, Economical  
**WIRE CONNECTORS**

"Roughing in" of permanent wiring is simplified with SCRUI-ITS. They form efficient and safe connections without using tape, solder or tools. Better mechanical contact—no shorts or grounding. Compact in size.

EASY TO USE.

1. STRIP WIRE ENDS
2. SCREW IT
3. THAT'S IT—WITH SCRUI-ITS!

Four sizes for joining many combinations of AWG solid and/or stranded wires.

101 USES . . . Here Are a Few!

- Fixtures
- Outlet Boxes
- Fuse Boxes
- Panel Boards
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- Switch Controls
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WRITE TODAY FOR  
**DATA SHEET**

No. U-4

It contains complete specifications on SCRUI-IT sizes, dimensions, uses, etc.

**SOLAR ELECTRIC CORPORATION**

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**Are You Drilling, Cutting  
and Chipping Concrete and  
Masonry the Hard Way?**



**Just try a  
*SYNTRON*  
ELECTRIC HAMMER**



**and see how quick and  
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**Save money and time**

*Write for illustrated folder*

**SYNTRON CO., 690 Lexington, Homer City, Pa.**



**OVER  
3000 OF 15 BASIC TYPES**

Many of these Commutators are in our stock ready for shipment. Other types and sizes may be made from our tools promptly. *Write or Wire*

**THE TOLEDO STANDARD COMMUTATOR CO.**

**2242 SMEAD AVE.**

**TOLEDO 6, OHIO**

**3 FACTORIES**  
*to serve you*

**TOLEDO · HOMER · HILLSDALE**

*Lighting Layouts.* Because of its longitudinal shape, the fluorescent lamp is influencing lighting layouts, especially in new plants. Most incandescent lamp layouts in factories have been on the basis of individual units, usually spaced in a symmetrical pattern. In relighting these plants, economy dictates that individual fluorescent units be used to replace the incandescent units. Because of the greater efficiency of fluorescent lamps, lighting intensities can be approximately doubled over incandescent systems, by using the same total wattage in fluorescent units as was used in the incandescent systems.

On new installations in new plants, or relighting installations where new wiring is also installed, continuous row mounting of fluorescent units is gaining in favor. The continuous row layout has the advantage of providing unusually uniform intensities when spacing between rows of units does not exceed the mounting height of the equipment above the work plane. It also permits machinery to be located for maximum convenience at any position on the floor area, without regard to the lighting system layout in most instances. Diagonal mounting of the continuous rows is recommended in machine shops over lathes and similar machines having rotating parts on a horizontal plane.

Grid layouts are also used where high intensities are desired, and where minimum shadows and maximum diffusion are of importance. These layouts consist of continuous rows of equipment in one direction, and individual units installed at right angles to and between the continuous rows, or of individual units installed alternately at right angles to each other.

A fourth type of layout sometimes used advantageously consists of the correct type and size individual units located properly to provide directional light on machines or work areas around machines. This layout should be used only when the machines are permanently located, or when the type of mounting and installation is such that the units can be changed easily when it becomes necessary or desirable to change the locations of the machines.

A quick rule of thumb basis for making preliminary estimates of in-service footcandle intensities for new layouts is to assume 20 footcandles per watt per square foot, including auxiliary wattage, based on use of standard 40 watt white lamps, typical industrial reflectors and average conditions of color of ceilings and walls.



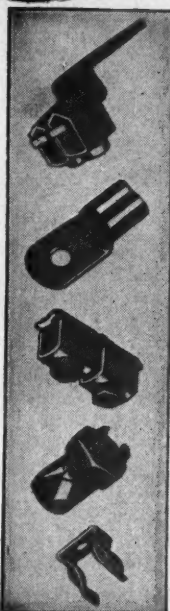
ILSCO OPERATES  
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**ILSCO**  
LUGS AND  
CONNECTORS

**Simplicity**  
In Design  
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FEWER parts, more skillful engineering design and construction, easy swift installation . . . and copper 99.9% pure . . . 100% conductive . . . just a few reasons why you should"  
"GO ILSCO FOR '47'".

Write for 48-page illustrated catalog.



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COPPER TUBE  
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QUALITY and PERFORMANCE GUARANTEED  
TO MEET **ABOLITE** STANDARDS



**FORMED NECK RLM  
DOME TYPE REFLECTORS**

*Porcelain-on-Steel*

Finest quality, durable and efficient for all industrial lighting. Abolite reflectors are also made in Easy Detachable, Threaded Neck and Separable Socket types.

The RLM label on an Abolite reflector signifies that it conforms with all the rigid specifications set by RLM Standards Institute, of which Jones Metal is a member.

New plant improvements, including another continuous furnace of latest design, are now under construction. Increased production will make Jones your most dependable source of supply for porcelain-on-steel lighting reflectors.

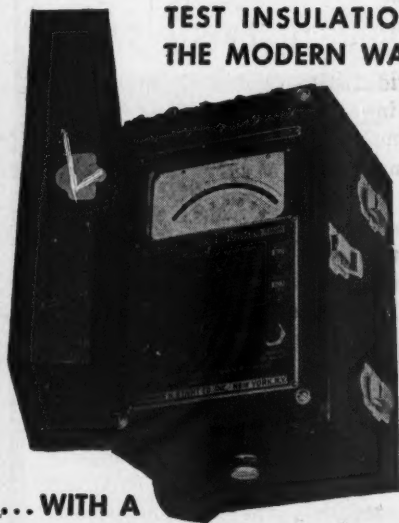
You can depend on the "Old Reliable" Abolite . . . sold exclusively through wholesalers.



Light right with . .

THE JONES METAL PRODUCTS CO., West Lafayette, Ohio

TEST INSULATION  
THE MODERN WAY



... WITH A

**MEGOHMER**

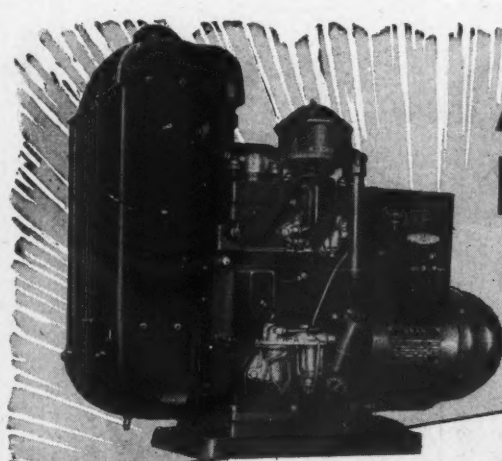
**NEW NON-CRANKING TYPES**

No more tiresome cranking of a hand-driven generator. Steady test potential of 500 volts D.C. instantly available at turn of switch. Direct readings of insulation resistances without calculations. Two types, Model B-5 and C-2. Ranges 0-200 megohms, and 0-100/1000 megohms with 1, 2 or 3 additional ohm scales in same instrument. Write for Bulletin No. 435T-445T.

HERMAN H.

**Sticht**

COMPANY, INC.  
NEW YORK, N.Y.



**A.C. or D.C.  
POWER**

PORTABLE,  
STANDBY OR  
STATIONARY

You can simplify any power-for-electronics problem with an ONAN Electric Plant. A wide range of models and sizes makes it easy to choose the right plant for the particular application.

Lightweight one or two-cylinder air-cooled models for easy portability—A.C.-350 to 5,000 watts, D.C.-600 to 5,000 watts.

Onan two, four and six-cylinder water-cooled models are built for continuous heavy-duty operation, stationary or mobile. A.C.-3,000 to 35,000 watts, D.C.-3,500 to 10,000 watts.

ONAN Electric Plants: A.C.-350 to 35,000 watts in standard voltages and frequencies. D.C.-600 to 10,000 watts, 115 and 230 volts. Battery chargers—500 to 4,000 watts, 6 to 115 volts.

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2126 Royalston Ave. Minneapolis 5, Minn.

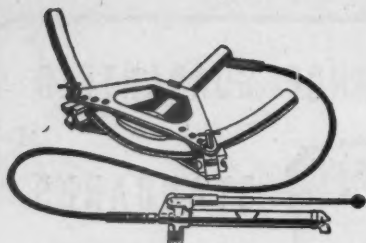
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**ONAN ELECTRIC PLANTS**



## When you buy a **BENDER**

*..check to make sure  
you get these features:*

**EASY TO GET TO THE JOB**



✓ Lightweight, portable—one man can easily take a Blackhawk Pipe Bender right to the job. Bends rigid conduit and pipe in all popular sizes, up to 4" dia.

**WORKS AT ALL ANGLES**



✓ The compact hydraulic Porto-Power Ram is all-directional. Power eliminates need for heating the pipe.

**WORK OVERHEAD**



✓ All-directional operation and light weight enlarges range of utility to use on ladders, scaffolds and cramped quarters and work on existing pipe runs.

**SIGHT FROM ANY ANGLE**



✓ Remote control permits operator to stand in any position for a full view of the job. Saves need for elbows, couplings, cutting and extra threading.

**DETACHABLE POWER UNIT  
FOR EXTRA UTILITY**



✓ It pulls gears, lifts machinery, and licks scores of other trouble jobs.

**BLACKHAWK  
Porto-Power  
PIPE BENDERS**

BLACKHAWK MFG. CO.  
Dept. P2047, Milwaukee 1, Wis.  
Mail Hydraulic Equipment catalog to:

NAME \_\_\_\_\_

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

## SPACING HIGHWAY LIGHTING UNITS [FROM PAGE 63]

luminaires contributed light to each square on the test area. A summation of all intensities thus attained, divided by the total number of squares (80), indicated the average intensity.

This resultant average intensity was found to be somewhat less than desired, so the intensities were refigured for a unit spacing of 80 feet. Inasmuch as the total light was now concentrated in a smaller area, the new intensity was closely approximated by dividing the total footcandle value by 64, rather than 80, squares. This new resultant was slightly higher than the established objective, so, by again relocating the lighting standards, a final spacing of 87.5 feet was selected. In addition to changing the longitudinal distance between staggered units, calculations were made for mast-arm lengths of 8, 10, 12 and 15 feet. The final selections specified 12-foot arms for center-island double units and 15-foot arms for single-lamp standards. This resulted in a transverse distance between lamps of 52.7 feet.

With standards located in accordance with these results, an average intensity of 0.569 footcandles was produced. Further calculations, based on the summation of footcandles plotted in the horizontal squares, revealed an average intensity of 0.87 footcandles along the innermost express lanes with a maximum of 1.15 footcandles directly opposite each twin-light center-island standard. A minimum average intensity of 0.538 footcandles illuminates the outer local lanes. These results considerably exceed the I.E.S. recommended minimum level of 0.3 footcandles for express highways with multiple lanes, center islands, negligible pedestrian traffic and lane-dividing curbs.

The resultant spacing of luminaires closely checks the accuracy of the spacing formula:

Spacing =

Lamp lumens x Coefficient of Utilization  
Average footcandles x Width of highway  
Knowing the lumens per lamp (6000) and the coefficient of utilization for a Type II luminaire (0.43), taking the total overall average footcandle intensity obtained above (0.569), and figuring the width of highway as the transverse distance between luminaires (52.7 feet), the resultant becomes:

$$\text{Spacing} = \frac{6000 \times 0.43}{0.569 \times 52.7} = 86 \text{ feet.}$$

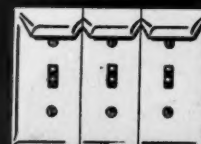
**LUMINITE**  
REG. U. S. PAT. OFF.



Automatic  
**SWITCH LIGHT**  
with the  
sealed-in neon glow lamp

provides

A nite-lite on every  
switch . . . a guiding  
light to every switch



For all single and multi-gang  
toggle switch panels. Matching  
units for convenience outlets

- LumiNite lights automatically when you turn room lights off!
- Goes out when room lights are turned on!
- Ends fumbling for switches in the dark!
- Its "safety" glow helps prevent accidents!
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- Shows when you've forgotten to turn off lights remote from switch!
- Operates for less than 2c per year!
- Lasts for years without a burnout!
- Operates on 2, 3 and 4-way switches!
- Listed by Underwriters' Laboratories!
- Adds extra profits to every wiring job! Write for LumiNite details or see your jobber today!

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